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VOL. 3, ISSUE 4
SINCE DECEMBER 1975

APRIL 1978

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MICROCOMPUTING FOR SMALL BUSINESS AND HOME

COVER STORY

Robotics, the next logical step for mankind. The robot on this month's cover appears to be contemplating his place in the scheme of things. Is he a man, an android, or merely a hunk of metal?

Cover designed by Pamela Mower

FEATURES

BUSINESS FEATURES

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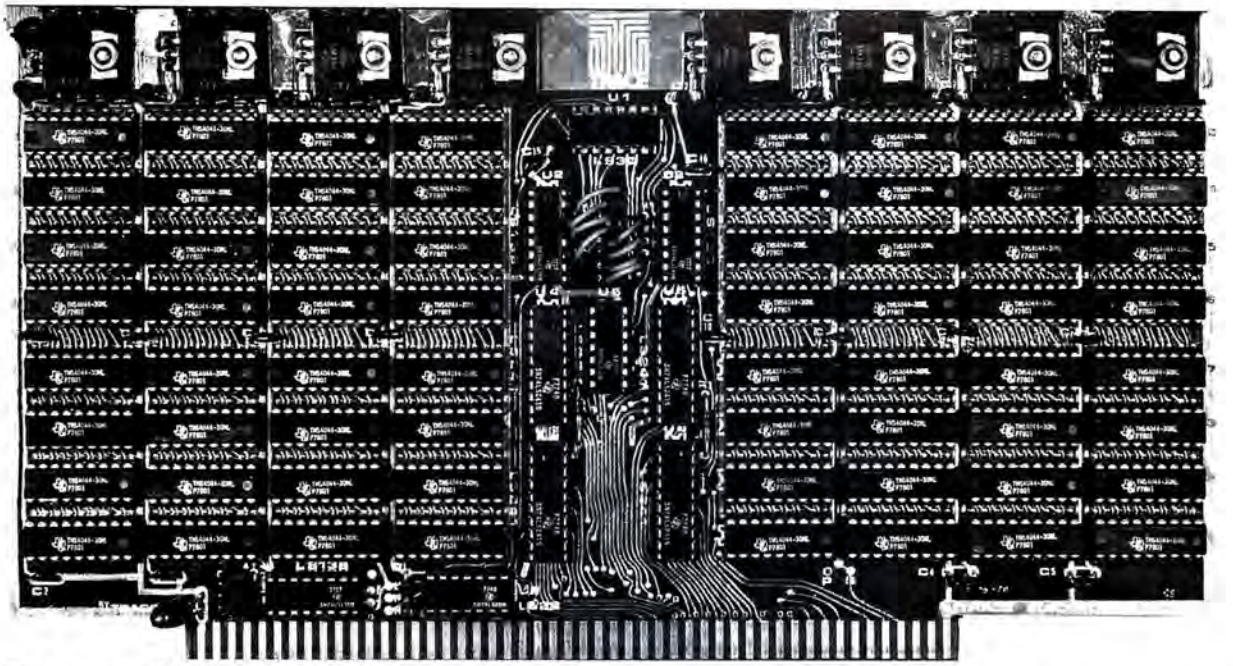

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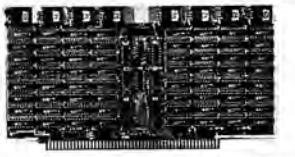

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EDITOR'S NOTEBOOK

April, at INTERFACE AGE, is traditionally the month to delve into the subject of robots. From the cover, you have probably guessed that this year is no exception. Within these pages, you will find several interesting and light hearted stories about robots.

This year we tried something new, and we hope you like it. This issue provides not only hardware robot stories, but stories covering just about every aspect of robotics, from Ray Bradbury's point of view to a quick look at the Star Wars robots.

While putting together this month's issue, we were in contact with several universities and companies that are involved in robot research and development. Unfortunately, due to deadlines, we were unable to secure articles from all the contacts that we made. But, I can mention a couple of them here.

Harvey Lipkin of the University of Florida, Department of Mechanical Engineering, called to let us know about their endeavors. It seems they are studying robot technology in a big way in Florida, and have developed some advancements in the field. I wish that we had complete details, but Harvey did promise an indepth article for next April, so it gives us all something to look forward to.

A phone call from Erik Lindholm, at Lour Control, 1822 Largo Court, Schamburg, Illinois 60194, informed us that his company was taking robotic control seriously. The folks at Lour, which incidentally is a manufacturer of electronic controllers, have developed a device they call the 'ET 2.' This robot device is a 15-inch tall by 12½-inch diameter mechanism that is designed to interface with hobbyist computer systems and is controlled by binary input, according to Erik.

Essentially, the 'ET 2' is a microcomputer controlled controller, or robot drive mechanism. The device can be used to automate inanimate objects or work as an integral part of a much larger robot system. The device seems interesting, and we have a promise from Erik to see the 'ET 2' next April.

Although robots are interesting, I must move on to two other subjects of equal importance, the first of which is the subject of clubs.

I have been a HAM for over twenty years, and have belonged to such clubs and organizations as the Denver Radio Club, ARRL, Carson Amateur Radio Club, and at one time the SCCS. Basically, I feel that the concept of a local hobby club is good. They provide a place for the novice to go and learn from more experienced members. Ideally, a well run club becomes a center of learning for all the members.

However, I am personally turned off by so-called national or international hobby clubs, whether it be for amateur radio or microcomputers. It has been my experience that a club of this nature turns into more of a political arena than a learning center and, consequently, does not do anybody any good.

It has been said that a national computer society will provide the clout needed to create bus and language standards. This I believe to be so much hokum. In the real world, standards are set up by international committees that represent the manufacturing world. Professional societies, such as the IEEE, are very much attuned to the problems of standardization and are continually working to develop usable standards. A hobbyist group, unless it is made up of several hundred thousand members and has a great deal of money, would not even be heard.

Therefore, what I would prefer to see is local clubs working to improve themselves, rather than trying to unite into one large unworkable club. The small clubs can make use of the magazines serving the industry as a vehicle to exchange information. As a result, INTERFACE AGE provides the Sense Line as a forum for any computer club that would like to provide an article. We not only provide the space, but offer normal article payment rates for the submitted articles.

Another subject that is important to mention is that of documentation. There seems to be a problem with, or a lack of understanding of just exactly what is required in documentation. This problem does not exist due to lack of standardization, (many texts and guides have been published addressing this specific area), but more to the lack of manufacturers and hobbyists alike failing to avail themselves of the correct method of telling someone how to use what they have created.

I receive several letters a day describing the problems that have re-

sulted because of less than adequate documentation. Unfortunately there is little I, or INTERFACE AGE, can do when the problem is related to a specific product, other than forward the letter to the appropriate person at the company, for the purpose of eliciting a response to the writer.

However, we have taken some important steps to minimize documentation problems within the magazine. One is the style guide which can be found on page 32a of the March issue. We are also paying more attention to detail and have set up strict evaluation standards. Hopefully, our efforts and the efforts of other magazines will set a trend, and force better written documentation to become available.

Several readers have requested the style guide mentioned in my February editorial. As I previously mentioned, you will find it on page 32a of the March issue. However, to further assist you in your writing endeavors, we would like to pinpoint some of the areas we are currently seeking articles on.

We would like to see stories written about the use of the microcomputer in any business venture. These may be stories on how you implemented your system in your butcher shop, or how you use it in some form of process control. If you are involved in system design, you might consider a story on the actual design work that you do.

Also, we are interested in stories related to the home use of the micro. This type of story can cover environmental control, as an example, and show the hardware and software that is associated with the package.

Of course, we are interested in technology stories, such as the 101 parameters of CCDs.

The field of microcomputer technology is growing every day. What we see now will be totally different tomorrow. As a result, it becomes impossible to even guess what might be around the corner. Therefore, if you have an idea for a story, and are not sure if it fits, send in an outline. We will gladly make our comments and return it to you. It's much better to have an outline returned than a complete manuscript.

When you write that article, and get ready to send it to INTERFACE AGE for publication, send it only to us. Should we decide that we cannot use it, we will return it immediately, so you can submit it elsewhere. The biggest mistake that you can make as an author is to send your work into several publications at once, bartering for price. What happens is that you may get published once, but will end up seeing your stories returned on a regular basis. Remember, the journals serving this industry are being fair with you, so be fair to the editors.

If you are planning an article do not worry about deadlines, unless you are contacted to do a specific story, at which time we will advise you of the deadline dates. Stories that are submitted to us are targeted to fit with a specific issue of the magazine sometime in the editorial year. Stories that do not have a target date are held in the 'swamp' and are used as the need arises. Unfortunately, we are not able to apprise authors of the target dates prior to actual publication.

When your article is accepted for publication, you will receive a contract, and a binder check. It is imperative that you return the signed contract as quickly as possible to ensure that your story can be handled in the most expeditious manner. The payment figure quoted on the contract is based on the estimated size of the story. In most cases this figure will reflect the actual final payment.

Regarding proof sheets, we are presently unable to provide them prior to publication. However, when we do implement this procedure, it will be necessary that you understand their correct usage.

The proof sheet is provided to authors as a check to make sure that all wording is correct to the understanding of the story. The proof sheet is not a vehicle to allow the author to rewrite the story, but merely to make minor changes. It must be remembered that the editors have the final say on the article content and structure.

In summary, make sure that when you submit an article that all the parts are there, and that it is technically correct. Do a fog count, and take out the baloney. Always be sure to tell them what you want to tell them, tell them, and then tell them what you told them. DO THE STORY RIGHT THE FIRST TIME. If you are asked to rewrite it, don't take affront, but welcome it as an opportunity to improve your writing skills.

Alright, with all of that behind you, put the style guide between your computer and typewriter and get going.

One last point, for those planning to write a letter to the editor. Please address it: Letter to the Editor, INTERFACE AGE Magazine, P.O. Box 1234, Cerritos, CA 90701, and indicate whether or not we can publish your address.

—Carl

LETTERS TO THE EDITOR

Dear Editor:

I realize now what attracts me to your magazine; it's the subtitle, MICROCOMPUTING FOR SMALL BUSINESS AND HOME. The text sure follows this description.

I'm happy to see that publications in this field are starting to become more realistic in portraying the real role that microcomptuers will play in people's lives. Through your pages, we are receiving the softwar solutions to our everyday problems; and as a technologist, I couldn't be happier. I can't give enough praise to articles like "Personal Accounts Payable Program" and "The Word Processor." Routines like these will be the motivating force behind microcomputer sales; and once the 'average Joe' finds that, for exámple, he no longer has to sort through a shoe box full of bills every month, that there's a better way, all this ground work that publications like yours are doing will pay off.

The software section is the best part of the magazine; however, it has one major shortcoming — lack of program documentation. I realize that this isn't so much your fault as it is the fault of your contributors. If it was up to me, I would have to insist that, for the benefit of my readership, the authors of any software include the following items:

1. A flowchart which documents the logical flow of the program. Also, it is extremely useful if line statement numbers are indicated beside each functional block.
2. A table of the program variables, alphabetized and defined.
3. A description of any BASIC keywords, operators, etc., that are particular to the brand of BASIC used to encode the program.

Now that we're getting the software, let's see articles on the systems. Maybe the owners of these machines could take a few minutes and tell us all something about what they are currently using in the way of hardware.

Richard H. Bley
Hickory, NC

Richard, do we have a surprise for you. In the March 1978 issue you will find: A style guide requesting the information you suggested, and Dr. Perez's editorial on program design. Over the next several months you will see some very indepth tutorials on programming in general and the BASIC language in particular.

—Editor

Dear Editor:

I wish to draw your attention to several problems in the program listing for Mr. Michels', "How To Buy An Apartment Building" (INTERFACE AGE, January 1978).

In line 1070, the correct multiplier would be 1.5, not 1.25 as shown. In line 1020, the THEN destination should be line 1060, not 1020 again. However, until the problem noted in the paragraph below is fixed, this infinite loop is of no consequence, since there is no path line to line 1020.

This more serious error is that annual allocation of personal property depreciation is not added to the allocation of building depreciation at line 1080. All run examples in the article contain erroneous "Depreciation" and "Taxable" values. This error is caused by incorrect GOTO's at lines 890, 920 and 950. To correct the situation, delete line 950 and change lines 890 and 920 to "GOTO 960."

Another, possibly interpreter-related problem, is that "T" is used both as a variable and an array name. Our TEKTRONIX 4051 treats all unsubscripted references to an array name as pertaining to each element of the array. To isolate these references, I substituted the variable T1 for T in lines 1140 and 1150. In line 1460, I used T9 for T, and printed T9 in line 1760.

The program as modified appears now to be running correctly, and should be of great value to those persons wishing to optimize their real estate investments.

Owen Carlson
North Stonington, CT

Owen, thank you for pointing out the indicated errors, the program was evaluated by an outside source, and passed as okay. Still, we offer no excuses. Thanks for the corrections.

—Editor

Dear Editor:

I saved a shopping back full of literature picked up at Atlantic City for winter reading, so I just discovered INTERFACE AGE. I haven't been able to put it down since. Here is a check for a subscription.

I particularly liked the detailed advertisements, August 1977, issue. Concerning the Sidereal/Solar Clock by John O. Bumgarner, I am sure there are uses for this program, but for the North Atlantic Captain-Navigator of aircraft in 1940-41 (WWII). What we did was set one navigator's watch to sidereal time, and have a good draftman mark it to read degrees @ 15° per hour. Another watch is set at GMT, since D/R and ETA's are expected in solar time.

Where is there a good glossary of abbreviations and acronyms?

Grafton Carlisle
Burlington, VT

Thanks for the nice words, Grafton. You might contact the book publishers advertised in this issue for information on a good glossary.

—Editor

Dear Editor:

I would like to respond to some of the points mentioned in a letter from Don Walters on page 49 of the January 1978 issue of INTERFACE AGE. The letter concerned the S-100 bus.

First, as is mentioned, many manufacturers do produce equipment which is "S-100 bus compatible." This is in quotation marks because nowhere is the S-100 bus rigorously defined. This lack of definition allows several products on the market today, all to be "S-100 bus compatible," but to be incompatible among themselves.

Second, Mr. Walters points to the 16 lines not specified by Altair® as an advantage since they can be used in the future for signals not considered necessary when the bus was designed. These 16 lines have turned into a double-edged sword, however, since whenever a manufacturer designs a new board which needs a new line, he will pick one of the 16 at random, even though some other manufacturer might have picked it for some other signal. Again, incompatibilities occur.

Lastly, Mr. Walters wonders why no one has come up with a 6800 or

6502 board for the S-100 bus. A quick look at the signals available on the bus and those generated by a 6800 or 6502 should answer this question. There are just *too many* signals on the S-100 bus and most of them are unique to the 8080 processor. For the last year I have been homebrewing a 6800 computer on the S-100 bus (or at least, as close as I can come) and I can verify that to make an S-100 bus 6800 card (or because of its similarity, a 6502 card) completely compatible with even a majority of the products on the market today would be nearly impossible. Evidence for this is the fact that even MITS didn't use the same bus when they made a 6800-based computer.

In conclusion, I feel that it is unfortunate that the S-100 bus has become as much of a standard as it has. It is possibly an acceptable bus for an 8080 or Z-80 system, but is hopeless for most other processors. Since it has become the "standard" for hobbyists, hobbyists are somewhat locked into the 8080 and Z-80 and can't get experience with many of the other excellent processors on the market.

Bruce A. Anderson
San Diego, CA

Very interesting, and I both agree and disagree with you. First, incompatibility does exist with S-100 type cards, and this is due to a lack of standardization among manufacturers. Second, you can put a card designed for the S-100 bus on the 6800 bus, if you are willing to due some surgery. —*Carl*

Dear Mr. Turner:

I have recently studied the "General Ledger" program published in your September 1977 issue on a "Floppy ROM". INTERFACE AGE is offering an extremely valuable service to its readers in the essentially "free" publication of software of such complexity and quality. I appreciate the enormous amount of work required both to write the program and to produce the "Floppy ROM." However, this great service and enormous amount of labor are of absolutely no value to me, or to most of your readers, because we do not happen to own an "Altair," and thus can not decode the very peculiar "mnemonic BASIC" you have used in recording the "Floppy ROM." What a waste!

Of course, I can (and probably will) rewrite the whole program from your three-part article. But, if I have to duplicate all the work that went into the "General Ledger," then your labor has given me very little service indeed.

I thought that one of the major objectives of "higher level languages" was to produce "machine independent code." By recording your "Floppy ROM" in a code that only "Altair" can read, you have totally defeated this purpose.

Ordinary BASIC would be great, but this "mnemonic BASIC" you have used is of even less widespread use than any particular machine language. If you had recorded the program in 8080 *machine language*, you would have *increased* the number of readers who could use the "Floppy ROM" by a factor of 10 or more! How many home computers use 8080 or Z-80 CPUs, and could thus use a program encoded in 8080 machine language? Now, how many can decode Altair's peculiar "mnemonic BASIC"? Why bother writing programs in BASIC, which is slower and bulkier than machine code, if you are going to publish them in a form that *most* computers can't interpret?

I would like to offer you my commendation and appreciation for such pioneering work in making software available to home computerists. I hope that future efforts can be published in a form which is usable by a larger percentage of your readers.

J. Craig Lewis
Peninsula, OH

Branched to Next Page

Yes, but wasn't the concept grand? You are not the first to mention that there are difficulties in using the Floppy ROM. Therefore, the engineers are working to make the ROM usable by just about everyone, and as they reach that goal, it will appear in the pages of INTERFACE AGE.

—Bill

Dear Editor:

I am very interested in developing dedicated educational uses of microcomputers. My background has been and is in secondary schools as teacher and administrator. I would like to identify persons who also believe that education can and should benefit from technology (in particular, microcomputers) and have the technical know-how to indicate how some creative uses of microcomputers might be implemented. Can you offer any suggestions? I would appreciate any leads: names of persons, groups, etc.

Brother Eugene Meyerpeter, S.M.
Marianist Educational Associates
1223 Mayhurst Dr.
St. Louis, MO 63122

Brother Meyerpeter, I really want to answer your letter indepth, but am unable to for lack of concise information. Consequently, we are publishing your address with hopes that readers with the same idea will contact you. Also, we will be publishing an issue that is geared primarily to using the micro in education.

—Editor

Dear Editor:

I learned a lot from the first issue I read of INTERFACE AGE (January 78) and look forward to future issues.

Since Judy and Larry Robertson panned *Interfacing Selectrics to Microcomputers*, perhaps they could recommend an alternative. In the same issue was an advertisement for a Sharp & Associates Conversion Kit (Page 14, RS No. 47). Is that kit adequate?

John Hemphill
Takoma Park, MD

John, you must remember that a review is only the views of one or two people. You will notice that we have a letter from the authors, answering the review. Personally, I do not know of a better source to go to.

—Editor

Dear Editor:

Your review of our book *Interfacing Selectrics to Microcomputers* had a few errors, and if possible, we'd like to clarify.

We designed the interface because at the time (April, 1977) there was no selectric interface on the market. We were doing a lot of correspondence and writing and needed the selectric on our microcomputer.

Our selectric operated eight months with the interface under heavy usage with NO down time. The repair at eight months was

minor — a solenoid readjustment. We challenge any current manufacturer with this record. We're still using the system.

Our interface can be used in a completely closed loop mode. We haven't wired ours this way because our repairman says that the wear in our current partially closed loop mode is minimal and clutch replacement, if necessary, is a minor repair job. We've processed two books and hundreds of letters with the machine. We're now working on two more books with it.

Our circuit does have some overkill features, but most of these did not affect production costs and were left in as part of the circuit.

The only problem in our current circuit is the lack of any lookahead feature. We plan to add this in 1978 and will probably include this in the next edition of the book.

The current book price is $14 due to increased printing costs. The interface is also available, as well as assembled terminals. (Yes, this letter is typed on the system!)

Carl Townsend
Portland, OR

See, Carl, having your book reviewed isn't all bad. At least you are getting the chance to add your personal comments. —*Editor*

Dear Editor:

The Bible contains about 3.5 million characters and it obviously would be a large data entry task to translate this into computer format. Thus, I have made this attempt to solicit help from others in mutual sharing of the effort to place the KJV into computer format. Possibly later other versions could also be computerized.

Also needed will be a text editing-word processing program to handle the storage, retrieval and updating of reference notes relating to the various Bible verses. The ability to cross reference and display verses which contains related information is desired and will be a task to program, which possibly could be better handled by a mutual sharing of effort. There could be a problem of incompatibility between systems to be worked out.

Once the data base and the programming is established, it should be possible to use it to cross check references, and comments to see if there are any Bible verses to support or to oppose the subject under consideration. Also, a check can be made of any comments already entered into the data base regarding an explanation of the reference under consideration.

Another possible use could be the use of the original Greek and Hebrew texts to check out Translation accuracy and other problems.

If you are interested in taking part in this effort, or know of someone who would be interested, or if you

know where some of the above goals have already been accomplished, please contact me.

Larry E. Ellison
19 Huntington Lane
Wilingboro, NJ 08046

This is an unusual application, that I don't think anyone else has addressed. So if any of you can give Larry some input, please write directly to him. —*Editor*

Dear Editor:

As a DP professional, I view the announcement of the new 10 to 100 meg. disk drive memory sub-systems (*Electronics,* Jan. 1978, Vol. 5, No. 2, p. 33) with mixed feelings.

This development will at last put true workable mass storage within the reach of countless users who could not otherwise avail themselves of this much-needed capacity. The believably low $2,000.00 price tag generates an enormous market potential.

These new drives may cause an even larger revolution in data processing than the introduction of microprocessors, both for the industry by the elimination of high price tags and software headaches caused by too much data and too little storage; and for the users, as a whole slew of new applications and data management tools present themselves at an affordable price.

A computer system that is easy to sell and easy to program, is a software house's or OEM's dream. There is, however, a danger that this dream will turn into a nightmare. My concern is based on two major points.

First, are the limitations inherent in fixed disk systems. When a disk fails, (as all do as some point, either through hardware fatigue or software and operator errors), there arises a problem of data recuperation. In removable disk systems, external backups can be made and remounted. Data loss is limited to entries made since the backup's creation. Start-up time is the time it takes to get the disk back up and running. A fixed disk system calls for backup onto an external device, which can be a very slow process, or by one hundred percent redundancy; namely, buying two drives, and using one for backup purposes.

Due to the impracticality of backing up ten to one hundred meg. of data on diskette or cassette (ask any S/I user), the only practical solution is redundancy. The problem is that the low cost of these drives will open whole new markets of unsophisticated users who will not see the need for buying two drives until they call to cancel orders or sue because they have lost valuable data. Nobody needs this kind of aggravation.

In order to protect both the users and the industry, the drives must be designed with at least a backup surface for data recovery.

Second, a 100-meg. drive is a 100-meg. drive, and the software must be treated as such. Inadequate disk management systems are inexcusable, since the necessary software tools already exist. These devices will have to be provided with the proper routines, i.e., dynamic disk allocation, catalogs and catalog-path file allocation, binary files, spool and random access files, hash/sequential and multi-key indexed/sequential files (with keys in separate files), record oriented I/O and cylindrical allocations in multi-surface systems.

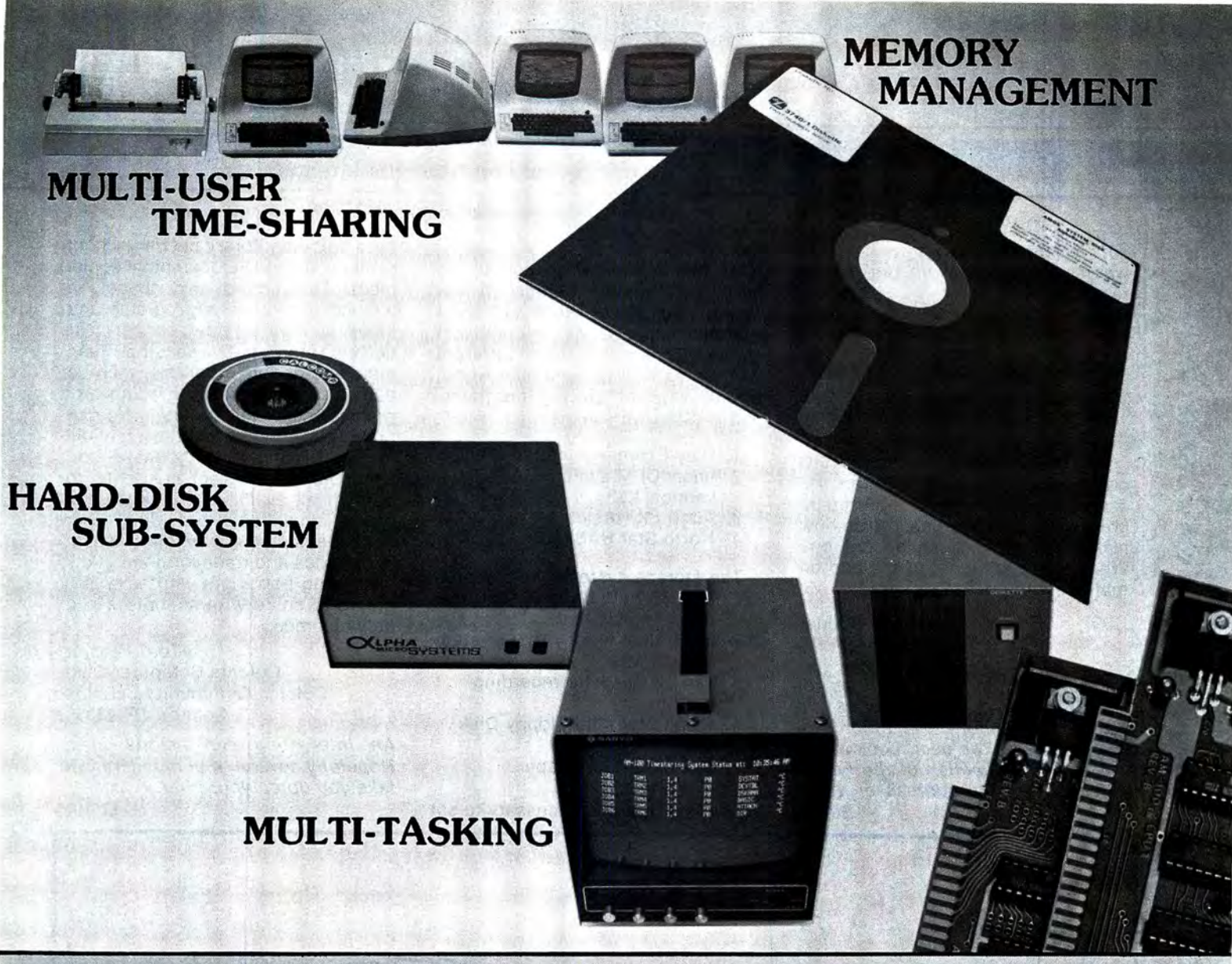
The most sensible solution is to take the standard routines and some diagnostic tourines, put them in ROM with a dedicated microprocessor, thereby making the drive intelligent, and to offer the controllers with serial, parallel and DMA interfaces for the major bus configurations (that includes the S-100 Bus).

Even if these steps triple the price of the drive, it still results in a vast improvement over present prices. These steps will also ensure the smooth and painless creation of new and lucrative markets as well as rapid acceptance by existing markets.

I hope the manufacturers will act on my recommendations, as I write this not as criticism, but merely with a critical eye. The only problems which don't occur are the ones that are foreseen and presented.

Charles A. Rovira
Adelphi
2250 Grand Blvd., #21
Montreal, Quebec,
Canada H4B 2W9

Charles, your letter is very interesting, and brings up some important points. Not only are we publishing



THE 16-BIT MICRO

Introducing the AM-100™, an S-100 bus compatible 16-bit microprocessor board set replacing 8-bit based processors. This CPU two board set offers multi-user/multi-tasking timesharing in an advanced disk operating system. It provides 16-bit flexibility and speed with 11 digit floating point arithmetic while supporting many of the economical S-100 bus peripherals such as static memory, memory paging and I/O facilities.

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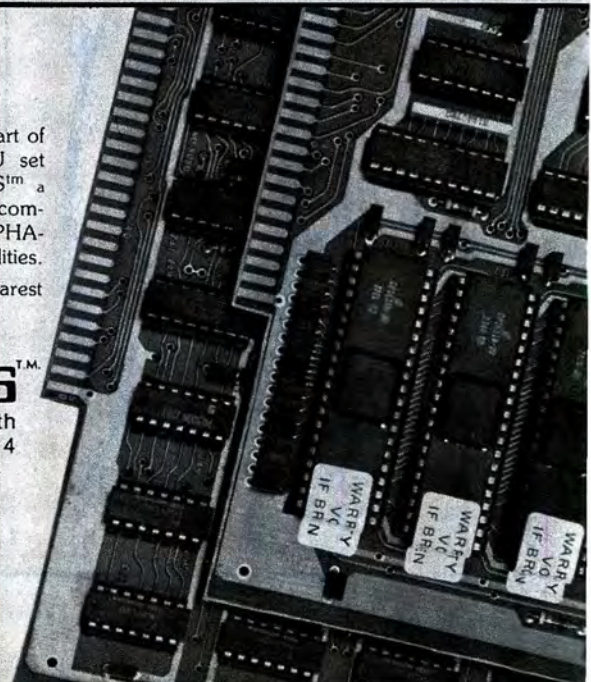


CIRCLE INQUIRY NO. 1

your letter, and address; we have forwarded a copy to several disk manufacturers. —*Editor*

Dear Editor:

I read your article on the Video Brain in February's INTERFACE AGE. Could you answer or tell me who to write to to answer the questions I have?

Will the VideoBrain work in BASIC or some other language? Can the cassettes used in the VideoBrain be programmed by the user? If so how many bytes (max) can be put on? Where can I get a list of the add on features and prices?

H.P. Bodnar
Pittsburgh, PA

Mr. Bodnar, the VideoBrain does not use BASIC, and the cassettes are read only memories and not programmable by the user. Look in the new products section of the February issue for the address of Video Brain. —*Editor*

Dear Editor:

At the Coloma High school we have a Computer Center. In our center we have eight different systems, plus a 3M model test scorer. These use four different BASICs as well as a number of different ways of storing programs. The BASICs we use are:

1. Poly Extended version A00
2. Imsai CPM system BASIC-E version 1.33
3. Altair 8K version 4
4. North Star BASIC

The storage systems we use are:

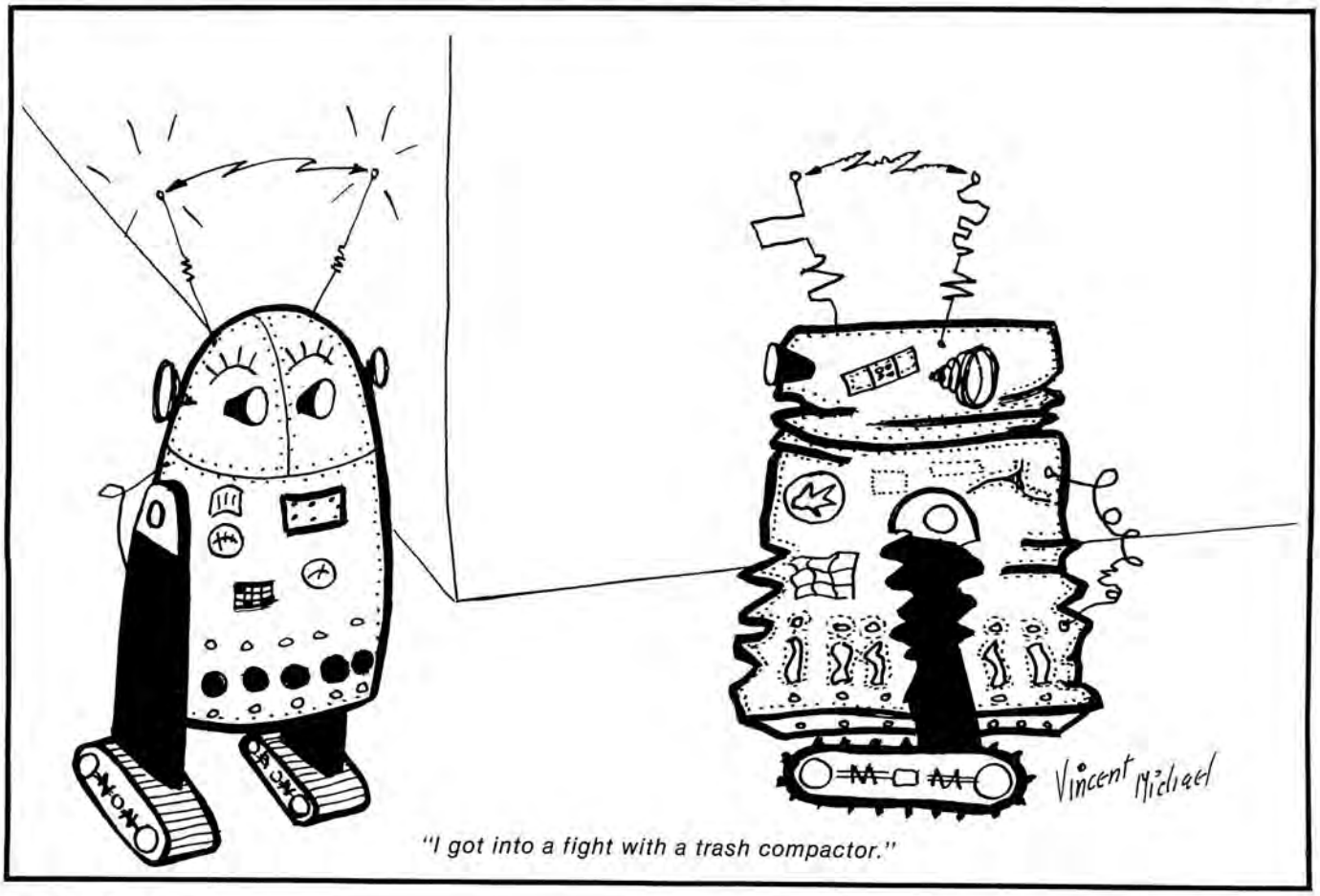
1. Poly 88 Byte Base Cassette recording system
2. Imsai dual Floppy Disk system with CPM
3. Tarbell Cassette recording system
4. North Star Mini Floppy Disk system
5. Standard Paper Tape

We feel that it is necessary to set up a software library betwen school systems using microcomputer equipment. This would give schools a chance to exchange programs and ideas, and to help other schools just getting started, by sending them already working programs such as games, memory tests, grading programs, and other material. We can provide programs to other schools in any of the above formats, and would be willing to act as a center to publish all available computer programs for schools, providing other school systems are willing to share in this idea and trade programs. Any interested hobbyists who have programs to share with schools would be welcomed.

Terri Leamer
Coloma Computer Club
Coloma Community Schools
Coloma, MI 49038

An interesting and helpful idea. Hopefully several of our readers will take you up on your offer.

—*Editor*



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Dear Editor:

Might I be permitted to mention a very few small errors in the editorial on page 62 of the January issue, concerning my word processor?

The 80-column line printer is not required; any 72-column printer or terminal will work. The CRT terminal is not required if the printer has a keyboard. There are no "LPRINT"s in the program. Memory should be about 20K of usable RAM after the interpreter is loaded.

Also, several times in the article "v" was used to re-enter a line. It should be a "^". Otherwise you seem to have done an excellent job of reproducing my article and program.

I hope these small errors haven't frightened off any potential users of the program.

Ken Knecht
Yuma, AZ

Ken, I owe you an apology. The editorial on how to load the Floppy ROM was paraphrased from Bill Turner's. Your listings were typeset, and that was why the ^ was inverted.

—Editor

Dear Editor:

I wanted to write to specifically praise Mr. Osborne's monthly communication in INTERFACE AGE. This must be a classic in providing clear, concise, accurate information in a sometimes confusing scene. I wait anxiously each month for INTERFACE AGE and the first thing that I turn to is Mr. Osborne's article. I had seen relatively little praise for "From the Fountainhead" in your letters and wanted to emphasize my appreciation.

Robert C. Luckey, M.D.
Richland, WA

We thank you, and Adam thanks you.

—Editor

Dear Editor:

I would like to point out an undocumented "feature" of the BLOCKADE game in your November 1977 issue. The invisible wall that surrounds most of the screen has a hole in it at the left of the bottom line of the screen and at the right of the next to bottom line. If one of the cursors is directed to pass through one of these holes, the cursor will wrap around the the opposite side of the screen rather than ending the game. The holes can be patched by changing the following lines of the PL/M program:

```
Replace: 25200
         DO TESTADR = 0CC00H TO OCF40H BY 40H;
With:    25200
         DO TESTADR = 0CC00H TO 0CFC0H BY 40H;
Replace: 25700
         DO TESTADR = 0CC3FH TO OCF7FH BY 40H;
With:    25700
         DO TESTADR = 0CC3FH TO 0CFFFH BY 40H;
```

In the object listing, the same change can be accomplished by the following:

Location 323H replace 40 with C0
Location 36EH replace 7F with FF

There is also an error in Figure 1 of the BLOCKADE article. The UP and DOWN sense switch labels are reversed for both players.

I found the game as addicting as the author claimed. The most insidious feature is that a new match is immediately started once the last is finished; no quarter or other response is required.

Dan Elliott
Sunnyvale, CA

Thanks for taking the time to point these errors out to us, Dan. Unfortunately, we can't be perfect all the time. Glad you enjoyed the game.

—Editor

Dear Editor:

Re: Point Humans. Mr. Cooper makes the statement "The cognitive powers of a point human include a perfect memory, flawless deductive powers and an unerring sense of direction." I have taken the word *include* to be an invitation to help complete the set of cognitive powers. A previous statement that the point human "is a monocular being" dictates the need for the cognitive power to include the ability to perceive distance, and the point human sees the same view in all directions.

A vector has both direction and magnitude (angle and distance). The cognitive powers of the point human may be said to include a perfect memory, flawless deductive powers and a vector sense.

I have written this letter because the article initially struck my interest. Upon rereading the paper I see that it is mostly speculation without basis. Is it a new approach to a topological problem? Is it a survey of a well developed method? What I am leading up to is a request that articles begin with a good introduction or abstract and that a few notes about the author be available at the beginning or end. It should not be necessary to look up the references to determine what subject an article is dealing with.

One last note: The use of invented words (locomotory?) very definitely dampens the enthusiasm of the reader. In this case it is not a problem, as the author's intent is obvious from context. I cannot stress enough the need for concise writing when trying to convey conceptual material.

Charles T. Springer
Gig Harbor, WA

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UPDATE

NEW EXHIBITS RECORD WILL BE SET AT 1978 NATIONAL COMPUTER CONFERENCE

The 1978 National Computer Conference, to be held June 5-8 in Anaheim, will feature the largest exhibit of computer hardware, software, systems, and services ever held. According to an announcement by the American Federation of Information Processing Societies, Inc. (AFIPS), sponsor of the annual NCC, all exhibit space for NCC '78 is sold out, with more than 330 organizations reserving 1,382 booths . . . surpassing the previous record of 1,146 booths set at the '77 NCC in Dallas.

According to Jerry Chiffriller, director of NCC operations, the new record in total exhibit space was made possible through reservation of all 277 booths in the West Hall in addition to available space in the North and South Exhibit Halls and the Arena of the Anaheim Convention Center. Construction of the new West Hall for NCC '78 was authorized by the NCC Board to accommodate those exhibitors who initially were unable to obtain exhibit space for the conference.

Organizations participating in the NCC '78 exhibit program include virtually all major U.S. suppliers of computer products and services, in addition to a number of prominent overseas organizations. More than 4,000 industry representatives will be available during the four-day exhibit program to demonstrate their latest products and services, provide technical and commercial data, and to help attendees find solutions to their information processing needs. The exhibit program will include competitive offerings in a wide range of areas including components, data communications equipment, education and training materials, minicomputers, microcomputers, microprocessor systems, mainframes, memory systems, software systems, test equipment, terminals, and other computer peripherals.

In addition to the conference exhibit program in the Anaheim Convention Center, NCC '78 will also feature a separate exhibit of consumer computing products and services as part of the Personal Computing Festival to be held June 6-8 at the nearby Disneyland Hotel Convention Center. Exhibit space in the PC Festival is still avaiable to organizations serving the personal computing field. Information on participating in the Festival exhibits may be obtained by contacting *NCC '78*, c/o AFIPS, 210 Summit Ave., Montvale, NJ 07645, (201) 391-9810.

FIRST ANNUAL COMPUTER FAIR OF EAST TENNESSEE

The Computer Club of Walters State Community College, in cooperation with this institution, is sponsoring the First Annual Computer Fair of East Tennessee. East Tennessee encompasses, within a radius of 40 miles of our campus, a population of over one million (including the Tri-Cities area and Knoxville).

The college and administration invite you to participate in this computer exhibition. One of many intended purposes is to enable area business and other professional

CIRCLE INQUIRY NO. 36

people to see first hand the wide variety of computer equipment available today. We hope you will invite all potential customers to see your equipment on our campus at the Fair on May 3rd. We will also engage in an intensive publicity campaign throughout the East Tennessee area.

The Fair will be held on May 3, 1978 from 10 a.m. to 8 p.m. Set-up time will be either 8 to 10 a.m. on the morning of the Fair, or the evening of May 2nd. Members of the Computer Club will be on hand to help set up your exhibit. Tables and chairs will be supplied by the college.

There will be a charge of $15 per exhibitor. This fee will be used to establish a scholarship fund in computer science and to purchase a microcomputer for the Morristown Boys Club. The college will also receive a portion for the use of the gym and hallway space. You will be free to take as many orders as you wish without restrictions. The one time $15 charge is all you need to invest. There will be no admission charge for attending the Fair (door prizes awarded!).

We hope that many manufacturers will take advantage of this opportunity in an area that is ripe for further computerization of businesses, in education, even in the home with microcomputers. All levels of markets will be represented at this Fair. Because we are a state-supported institution, no parties can be excluded.

For additional information, contact William Parks (Faculty Club Advisor), Don Gholson (Computer Center Director), or Barbara Spann (Fair Chairperson), at Walters State Community College, Morristown, TN 37814, (615) 581-2121.

ISRATECH '78

IsraTech '78 is Israel's June 4-8 exposition of its rapidly-growing high technology industries. Already executives representing several hundred American companies are making plans to attent IsraTech '78, promising a record attendance.

These executives and the many more from around the world that are expected to attend IsraTech '78 will have the opportunity to see first-hand many of Israel's highly regarded technological capabilities in the fields of metal working, electronics, computers, and aerospace, among others. In addition to attending the metal and electronics show that will be a part of the exposition, American executives will visit industrial plants and Israel's famous research and development facilities as part of IsraTech '78.

Also, at meetings with Israel's industrial leaders, visiting executives will be able to explore the vast number of business opportunities in Israel, such as buying, selling, licensing, and investing. At seminars and meetings with top government officials and representatives of major trade associations, the visitors will have the opportunity to discuss the generous package of incentives Israel offers foreign investors.

In addition to the shows, seminars, receptions and trips to industrial plants and research facilities, the IsraTech '78 schedule includes special cultural and social events, including a program for those accompanying executives.

Five colorful and convenient travel

packages to IsraTech '78 are offered by the Government of Israel offices here for those executives interested. A brochure is available upon request.

For registration or more information on IsraTech '78, contact the Government of Israel Investment Authority, 641 Lexington Avenue, New York, NY 10022, (212) 486-8554.

CALL FOR PAPERS COMPSAC 78

Papers are being solicited for the Second International Conference on Computer Software and Applications — COMPSAC 78, to be held in Chicago, Illinois, November 13-16. Sponsored by the IEEE Computer Society, COMPSAC 78 will bring together computer practitioners, users, and researchers to share their ideas, experiences and requirements for applications software, management techniques, and software development support, including automated techniques. Papers in the following and related areas are invited:

- Software development methodology
- Data base management systems
- Transaction and information management systems
- Reliability and Maintainability
- Case studies
- Software tools
- Social, legal, and regulatory issues
- Operating systems including distributed operating systems
- Software management
- Data communication and computer networking
- Computerized decision making systems
- Applications in business, communication, education, energy, government, military, process control, and transportation
- Mini/Micro software development
- Organizational impact of EDP technology
- Application-oriented languages

Papers should range in length between 1000 and 5000 words. Submission deadline is June 1, 1978. Papers should be submitted for consideration to: Professor C.V. Ramamoorthy, Dept. of EE & Computer Science, University of California, Berkeley, CA 94720.

Authors will be notified of acceptance by August 1, 1978, and will be given instruction for final preparation of their papers for inclusion in the conference proceedings. Exceptionally high quality papers will be considered for publication in IEEE Transactions on Computers or IEEE Transactions on Software Engineering. For further information contact IEEE, P.O. Box 639, Silver Spring, MD 20901, (301) 439-7007.

PROFESSIONAL DEVELOPMENT SERIES OF 12 SEMINARS WILL BE FEATURED AT 1978 NATIONAL COMPUTER CONFERENCE IN ANAHEIM

The Conference will be held June 5-8, and the 12 Seminars will be organized under the direction of Gopal Kapur, a leading consultant from Danville, California. The seminars, which will augment the conference technical and professional program, will cover a wide range of areas critical to system development, structured methodology, software engineering, database management, and cost-effective computer usage.

Each seminar will consist of a one-day tutorial for computer specialists, users, and managers covering the latest development, applications, and trends in a specific area designed to increase professinal skills and aid in career development. All seminars will be conducted at The Inn at the Park, adjacent to the Anaheim Convention Center. To assure a maximum learning experience, attendance will be limited to 125 individuals per course. The separate registration fee for each seminar is $45 and includes complete course material plus access to the four-day exhibit program and the NCC '78 Personal Computing Festival at the Disneyland Hotel Convention Center.

Seminars will be conducted by nationally-recognized authorities experienced in conducting such courses. Four seminars are expected to deal with user-oriented management issues, with eight focusing on subjects of special interest to computer specialists.

Specific topics under consideration include managerial development, security and fraud, managerial opportunities for women, structured testing of large systems, database systems, structured design, structured programming, software engineering, cryptography, plus two seminars on microprocessor technology stressing hands-on experience with the Intel 8080.

Additional information on the Professional Development Series, plus further details on NCC '78 may be obtained by contacting AFIPS, 210 Summit Avenue, Montvale, NJ 07645, (201) 391-9810.

DALLAS TO HOST MICROCOMPUTER EXPOSITION

The International Microcomputer Exposition will be held in the Dallas, Texas Convention Center September 29 through October 1. Co-sponsored by several groups, including the American Association of Micro-

Puzzled About Computers?

Data Dynamics Technology has a library of answers . . .

1 **An Introduction to Microcomputers: Volume 0, The Beginner's Book**
By Adam Osborne. 226 pages, $7.50
This book has been written for readers who know nothing about computers, and it has been written for two audiences: 1) For those of you who have a real interest in learning how to use computers. 2) For everyone else — who must live with computers, and need to know a little about them. For those of you who have a real interest in learning how to use computers, this is the first in a series of books. After reading this book you will be ready to move on to "Volume 1 — Basic Concepts," which gives you the information you will need in order to use computers.
Order No. OSB6001, paper.

2 **An Introduction to Microcomputers: Volume 1, Basic Concepts**
By Adam Osborne. 287 pages, $7.50
The purpose of this book is to explain not only what microcomputers are, but in addition, why they must be evaluated in a way that differs so markedly from prior computer comparisons. The book does not assume you understand how computers work; therefore, computer concepts are described beginning with first principles.
Order No. OSB2001, paper.

3 **An Introduction to Microcomputers: Volume II, Some Real Products**
By Adam Osborne. 868 pages, $15.00
As the second volume in a two-volume set, the purpose of this book is to describe some real products which implement the general concepts covered in Volume I. In this book, devices of the 8080A, MC6800, Z80, and MCS6500 microcomputers are described in approximately the detail we believe to be necessary.
Order No. OSB3001, paper.

4 **Build Your Own Working Robot**
By David L. Heiserman
234 pages, $5.95
Here are complete instructions, plans, schematics, logic circuits, and wiring diagrams for building Buster, the most lovable (and mischievous) mechanical pet in the world! He'll serve you coffee or bring you the morning papers. He'll forage for his own "food" and scream when he can't find it. His "curiosity" will get him into one plight after another, but Buster has the capacity to get himself out of trouble just as easily as he got into it!
Order No. TB841, paper.

5 **Getting Involved with Your *Own* Computer: A Guide for Beginners**
By Leslie Solomon and Stanley Veit
216 pages, $5.95
This is the first major book by outstanding authorities that assumes only that you have an interest in what makes personal computers work and what can be done with them. It will not make you a computer expert, but it will teach you enough to understand what is going on and where to go for more information.
Order No. RID004-8, paper.

6 **Your Home Computer**
By James White. 220 pages, $6.00
For the pre-hobbyist and the microcomputer novice, *Your Home Computer* provides a complete introduction to the world of home computing, beginning with what computers are and how they work. This book requires no prior knowledge or experience in electronics or computing. It provides answers to your many questions about hardware, software, and the personal computing scene today.
Order No. DMX 05-1, paper.

7 **Instant BASIC**
By Jerald R. Brown. 180 pages, $6.00
Written for the inexperienced, this activity-oriented book will help you teach yourself microcomputer BASIC, and the similar DEC BASIC PLUS for programming your personal computer. There's never a dull page and plenty of activities . . . so have fun while you learn! For those of you who already know some BASIC, this workbook can teach you the new microcomputer dialect.
Order No. DMX 04-3, paper.

8 **Basic BASIC: An Introduction to Computer Programming in BASIC Language - Second Edition**
By James S. Coan. 288 pages, $8.95
The author uses over 100 sample programs to illustrate the essential techniques of the language and to integrate BASIC programming with mathematics. Each language statement or capability is clearly explained at the time that it is first used in a sample program. Every section is followed by practice problems.
Order No. HAY5106-9, paper.

9 **Problems for Computer Solution**
By Donald D. Spencer. 125 pages, $6.95
The purpose of this book is to bring together in one place a wide selection of problems suitable for computer solution. The 821 problems presented in this book are arranged by topic. Problems have been included from most mathematical disciplines (algebra, geometry, trigonometry, advanced mathematics, probability, statistics, number theory), science, chemistry, physics, business, biology, and game playing.
Order No. CAM019-6, paper.

10 **Microprocessors: From Chips To Systems**
By Rodnay Zaks. 416 pages, $9.95
Microprocessors is a complete and detailed introduction to microprocessor and microcomputer systems. It presents both the concepts, and the actual techniques and components used to create systems. It introduces the reader to the aspects of system operation, use, and design.
Order No. C201, paper.

11 **Microprocessor Interfacing Techniques**
By Austin Lesea & Rodnay Zaks.
348 pages, $9.95
Interfacing is no longer an art, but a set of techniques and components. This book will teach you how to interconnect a complete system, and interface it to all the usual peripherals. It covers hardware and software skills and techniques, including the use and design of model buses such as the IEEE 488 or S100.
Order No. C207, paper.

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12 TYCHON's 8080 Octal and Hex Code Cards

The code cards are a sliderule-like aid for programming and debugging 8080 software. Both cards contain all the standard mnemonics and either their corresponding octal or hex codes. The pocket size cards are 6.5 by 3 inches (16 by 8 cm) with color-coded instructions to provide a neat, logical format for quick reference. The back of both cards is printed with an ASCII code chart for all 128 characters plus the 8080's status word and register pair codes.

13 INTERFACE AGE Binders and Slip Cases

Collecting magazines can bring headaches — not to mention dust, ripped pages and misplaced copies. If you use your back issues of INTERFACE AGE as reference material, nothing is more annoying than taking time to find mislaid copies. Data Dynamics Technology is now offering deluxe binders and slip cases which will place each back issue of INTERFACE AGE at your fingertips. Each binder and slip case is constructed of a handsome blue vinyl with INTERFACE AGE stamped in gold foil on the front cover and spine. These rugged binders and slip cases can hold 12 issues each and will protect your back issues of INTERFACE AGE for years.

Instant BASIC
By Jerald R. Brown. 180 pages, $6.00
Order No. DMX04-3, paper.

Basic BASIC: An Introduction to Computer Programming in BASIC Language - 2nd Edition
By James S. Coan. 288 pages, $8.95
Order No. HAY 5106-9, paper.

Beginners Guide to Computer Logic
By Gerald F. Stapleton. 192 pages, $7.95
Order No. TB548, cloth.

The Systems Analyst: How to Design Computer-Based Systems
By Jerry T. Atwood. 225 pages, $10.95
Order No. HAY5102-6, cloth.

Accent on BASIC
By Donald D. Spencer. 104 pages, $5.95
Order No. CAM003-X, paper.

Microprocessor Programming for Computer Hobbyists
By Neil Graham. 382 pages, $8.95
Order No. TB952, paper.

Simplified Computer Programming — The Easy RPG Way
By Kelton Carson. 240 pages, $5.95
Order No. TB676, paper.

Problem Solving with FORTRAN
By Donald D. Spencer. 320 pages, $12.40
Order No. PH0094-3, paper.

Scientific and Engineering Problem-Solving with the Computer.
By William Ralph Bennett, Jr. 457 pages, $22.30
Order No. PH5807-2, cloth.

Techniques of Program Structure and Design
By Edward Yourdon. 364 pages, $21.10
Order No. PH1702-X, cloth.

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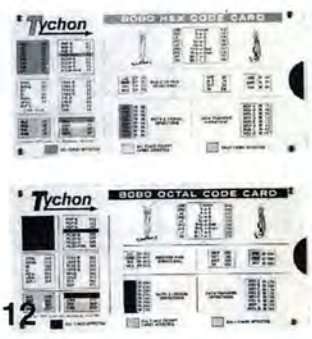
13



12

Everyone's getting personal in Long Beach.

3 full days of technical sessions, exhibits, home-brew displays and the latest on personal and small business computing, all at PERCOMP '78. April 28-29-30.

Just for the fun of it, we have an entire home-brew section... robotics, games, computer music, even every-day, sensible stuff like checkbook balancing and preparing *mailing lists*. You're sure to take home some new tricks to your computer.

And don't forget, PERCOMP '78 has booth after booth of everything in personal and small business computing.

Attorney Kenneth Widelitz will be on hand with some friendly advice on "Tax Aspects of Lemonaide Stand Computing" while his friend attorney Leonard Tachner delivers the low-down on "Patents, Copyrights and Computers."

Jim Butterfield is on his way from Toronto with the entire, unabridged truth about KIM. Jim co-authored *The First Book of KIM*.

5 months before show time our dynamite exhibit list includes from A to V:

The Astute:
Advanced Computer Products
Alpha Supply Co.
Apple Computer, Inc.
A-Vidd Electronics

Carol Anne Ogdin's keynote address bares the facts on "How Personal Computers Are Being Used Today." Carol comes to us from Software Technique, Inc. in Alexandria, Virginia.

Admission for 3 full days of personal computing, complete with 180 exhibits, 66 fascinating seminars and all the going and coming you want is $10 ($8 for students and juniors) at the door, and $8 ($6 for students and juniors) if you pre-register.

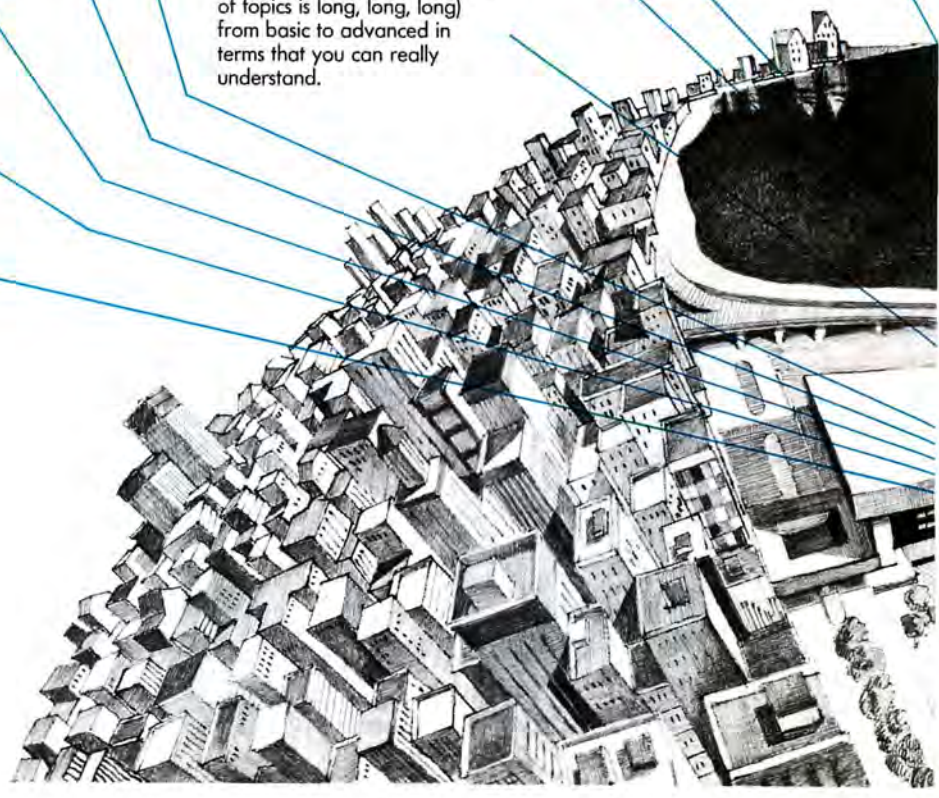
The Brilliant:
Byte Industries Incorporated
Byte Shop Lawndale
Byte Publications, Inc.

Dr. Portia Isaacson, a contributing editor for Datamation and an associate of Byte, brings computer enthusiasts the very latest word on "Computer Store Retailing."

Whether you're just a beginner or a well informed expert, you'll find the latest on ham radio communications, graphic systems, word processing, pattern recognition or...(our list of topics is long, long, long) from basic to advanced in terms that you can really understand.

Louis Field, president of the International Computer Society/ SCCS, gives you everything he's got on "Getting Started in Micro-Computing."

From Creative Computing Magazine comes David Ahl with all you'll ever need to know on "Marketing for the New Manufacturer."



CIRCLE INQUIRY NO. 96

The Captivating:
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Computalker Consultants
Computerland
Computer Magazine
The Computer Mart of Orange
Computer Pathways Unlimited, Inc.
Computer Power & Light Inc.
Creative Computing

The Dynamic:
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D.C. Hayes Assoc.
Dilithium Press
Dynabyte, Inc.

The Energetic:
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Entech

The Hearty:
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Hobby World

The Irresistible:
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The Jovial:
Jade Company
James Henry Co.

The Keen
Kathryn Atwood Enterprises
Kilobaud Magazine

The Magnificent:
Marinchip Systems
Micropolis Corporation
Mission Control

The Omnipotent:
OK Machine & Tool Corp.
Olson Electronics, Inc.
Optical Electronics, Inc.
Orange County Computer Center

The Personable:
Pan Dynamics, Inc.
Personal Computing
Problem Solver Systems, Inc.

The Quintessential:
Quainco Ltd.
Quest Electronics

The Remarkable:
Radio Shack
ROM Publications, Corp.

The Sterling:
SD Sales
Space Byte Corp.
SubLogic Co.
Sunshine Computer Co.
Sybex, Inc.
Szerlip Enterprises

The Tantalizing:
Tandy Computers
Tarbell Electronics
Tech-Mart
Telpar, Inc.
TLF, Corp.

The Ultra:
Ultra-Violet Products, Inc.

The Valiant:
Vector Graphics, Inc.
Vista Computer Co.

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PERCOMP '78

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(714) 973-0880

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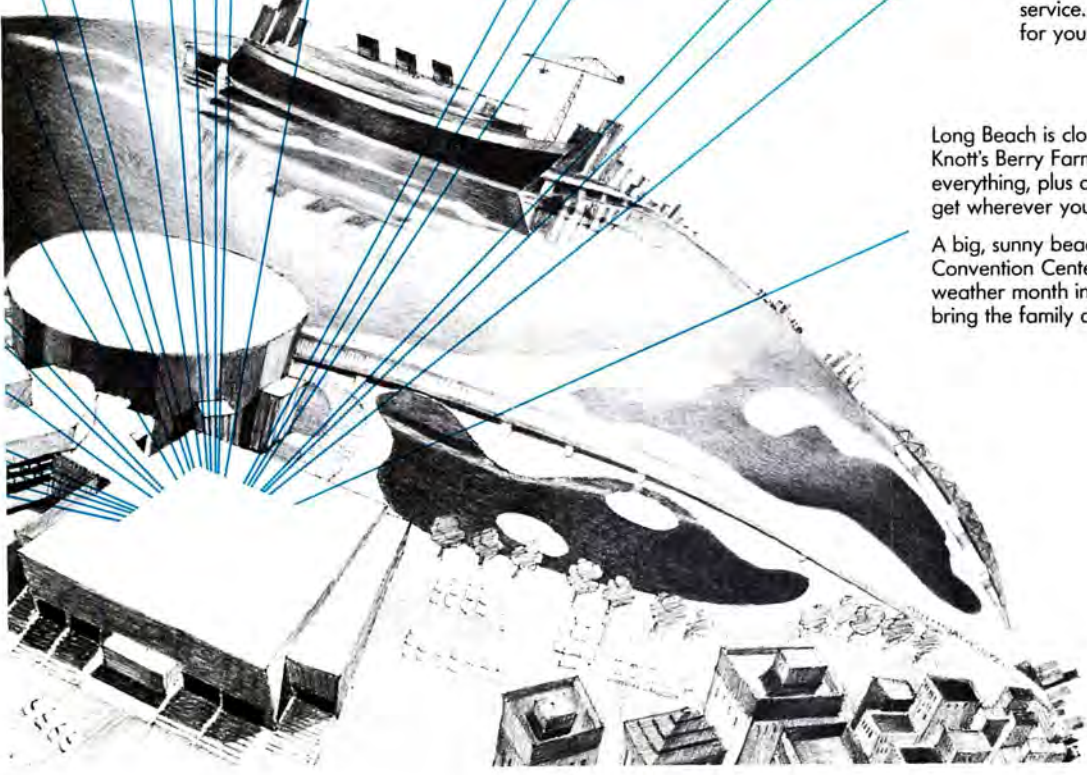
IA-4

Since everybody's coming, better make your advanced reservations. Pre-register and save (you won't have to wait in line) ...but don't forget about your hotel room. Our staff has reserved rooms in hotels and motels near the Convention Center. We've even arranged for a shuttle bus service. So call and we'll save a room for you.

Long Beach is close to Disneyland, Knott's Berry Farm, Universal Studios... everything, plus our staff will help you get wherever you want to go.

A big, sunny beach is minutes from the Convention Center, and April is a great weather month in Long Beach, so plan to bring the family and have a good time.



processors, the exposition will be directed toward all levels of technology from the professional engineer to the beginning computer hobbyist.

In addition to the seminars, a panel of experts will be available to answer questions.

Advance registrations indicate attendance in excess of 15,000 to view some 250 exhibits. Further information is available from Beverly Tanner, (214) 271-9311.

DATA 78

DATA 78, a new national forum for data and computer communications, will be held in Toronto, April 4, 5, and 6, 1978. Both a conference and an exhibition will be included in the event, which will take place at the Sheraton Centre.

There will be three full days of seminars, and panel discussions will cover areas of interest to the data processing manager, the communications network planner, and business executives.

Conference chairman is Richard G. Taylor, president and chief executive officer of Datacrown Ltd., Toronto. Banquet speakers are Professor Marshall McLuhan and Dr. R. Buckminster Fuller. Session chairmen have been appointed to lead each day's activities.

DATA 78 is expected to attract participants from across Canada, the U.S., plus some foreign delegates. Concurrent with the conference will be an exhibition of the latest in data processing and communications technology. For further information contact Sheila McLaughlin or Jean LaPrairie at (416) 967-6200.

CALL FOR PAPERS

This is to invite you to present a paper, participate in a panel discussion, display an amateur computer system or sponsor a tutorial at Amateur Computing 78, July 22-23. This will be a weekend microcomputer festival with attendance of several thousand people interested in personal computing from viewpoints of users and avid hobbyists.

Those interested in making a presentation should submit a letter of intent along with a one-page abstract or outline by April 15 to John W. Miller, Program Chairman, 6921 Pacific Lane, Annandale, VA 22003, (703) 256-5702. Authors presenting papers will be provided with instructions for preparation of camera-ready papers, which are due by June 1. Areas of interest are: personal computing applications, systems, hardware and software; amateur radio applications of microcomputers; home educational uses of computers; speech, music and graphics; standards for hardware, software and interfacing to the real world; and subjects of interest to beginners.

Commercial exhibitors will include retail computer stores, computer systems manufacturers, computer services, computer magazines and others. An exhibitor prospectus will be available from Amateur Computing, P.O. Box 682, McLean, VA 22101.

Amateur Computing 78 will be held in the modern, and completely equipped convention facilities of the Sheraton National Motor Hotel, which is near the Pentagon and overlooks the monuments of Washington, D.C. Out-of-town attendees should direct all requests for rooms to the hotel at (703) 521-1900 (not the toll-free 800 number), mentioning Amateur Computing. Or, write to the hotel at Columbia Pike & Washington Blvd., Arlington, VA 22204.

MEASURING THE VIEWABILITY OF LIQUID CRYSTAL DISPLAYS

Most liquid crystal displays operate in reflected light. The stronger the incoming light, the more readable the display. The contrast between the digits and the background, however, can vary and depends on manufacturing techniques, polarizers, applied voltage, and viewing angle.

Three engineering researchers at Beckman Instruments' Electro-Products Group in Fullerton, California, Chan Oh, Arthur Berman and Steve Quon, have constructed instrumentation and developed an effective technique for evaluating the viewability of wristwatch LCDs.

Their method measures the contrast at a series of polar angles resulting from measuring the reflected light as a function of applied voltage. Graphs of the data, drawn in perspective, provide an easy means of analyzing a specific display and of comparing different displays. The technique and graphs are the subject of a paper to be presented at the Society for Information Displays, San Francisco, April 18-20.

COMMERCIAL APPLICATION OF MINICOMPUTERS

The Commercial Application of Minicomputers Conference will be held on April 26-28 at the AMA Management Center, Chicago; on May 15-17 at the Royal Coach Motor Hotel, Atlanta, and on May 31-June 2 at the AMA headquarters in New York. This course is designed for directors of MIS, user managers who are a part of a team considering minicomputers, systems personnel who want information on minis, and executives in small to medium-sized companies who are considering computerization for the first time.

For additional information, contact American Management Association, 135 West 50th St., New York, NY 11020, (212) 586-8100.

MINI/MICRO SETS 24 SESSIONS 2 SEMINARS FOR PHILADELPHIA

Twenty-four half-day technical and business sessions and two special seminars were announced this week for the Minicomputer/Microcomputer Conference in Philadelphia, April 18-20.

The conference and exhibit will be held concurrently in the Philadelphia Civic Center. This is the third Mini/Micro event to be presented by Robert D. Rankin. The 1976 meeting and expo was held in San Francisco, and the second was held in Anaheim last year.

About 100 product and system manufacturers will introduce their new minicomputer and microcomputer products in twice that many exhibit units on the Civic Center exhibit floor, Rankin said.

On Monday, April 17, the IEEE will offer a one-day applications course, "Minicomputer and Microcomputer Applications." On Wednesday, April 19, the International Society for Mini and Microcomputers (ISMM) will present a course titled, "Step-by-Step Design of Microprocessor Systems."

For further information contact Robert D. Rankin, Managing Director, Mini/Micro 78 Conference and Exposition, 5528 E. La Palma Avenue, Suite 1, Anaheim, CA 92807, (714) 528-2400.

A COMPREHENSIVE LOOK AT DISTRIBUTED SYSTEMS

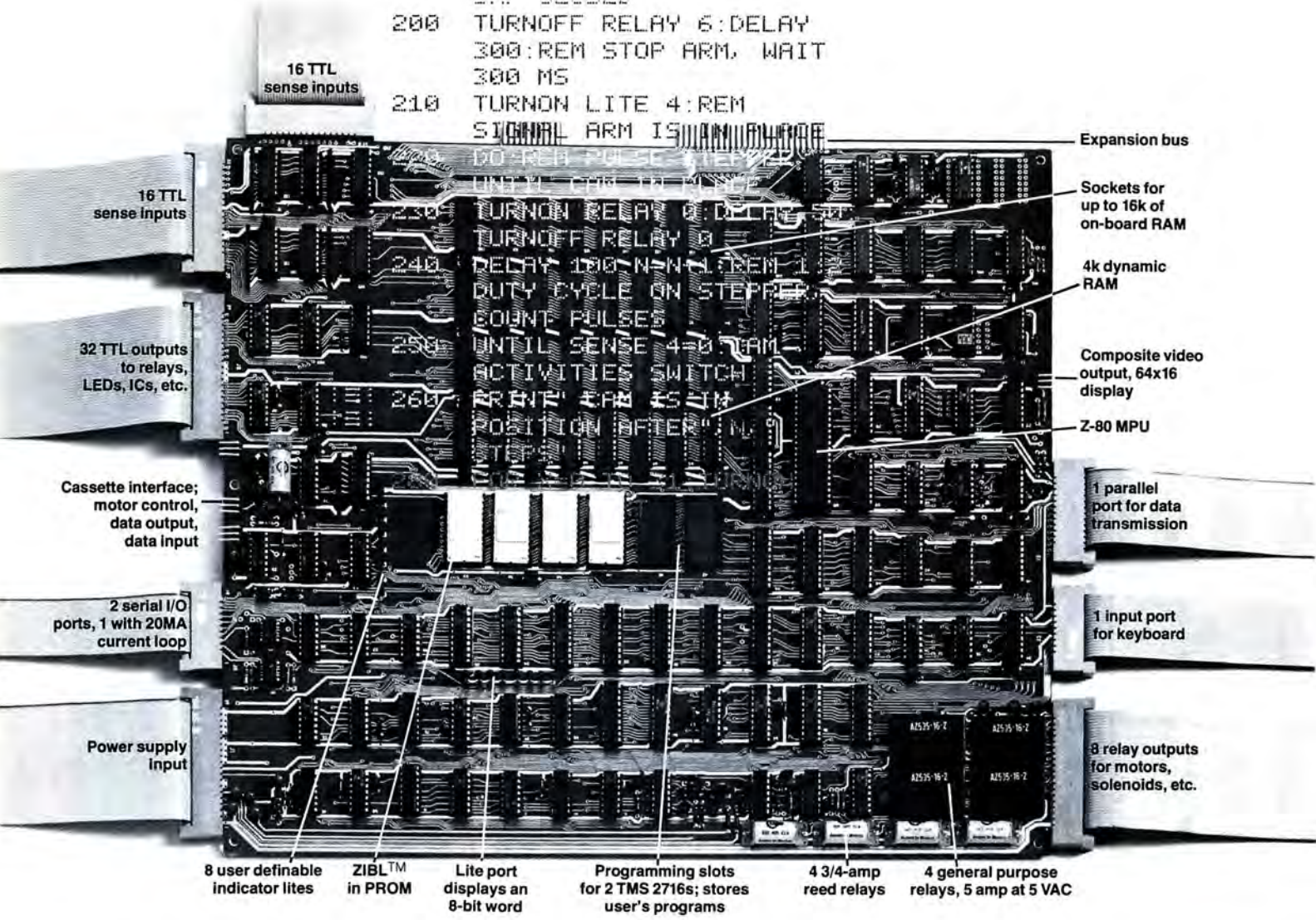
This specialized Seminar will be held in Atlanta on April 3-6 at the Royal Coach Motor Hotel. It will be a 4-day meeting which will start on Monday at 9:30 a.m. and end Thursday at 4:30 p.m.

The course leaders will be Alan Stutz of Price Waterhouse & Co., and John L. Hughes, Vice President of Services Management Group. The speakers will be Conrad Weisert, President of Information Disciplens, Inc., and Michael Parrella, President of Decisions Strategy.

For further information, contact Claire Levy, Program Director, at (212) 586-8100.

ADVANCE PROGRAM AVAILABLE

The Third International Conference on Software Engineering, to be held at the Regency Hyatt Hotel, Atlanta, Georgia, May 9-12, 1978, announces the availability of the ad-



Dynabyte's new Basic Controller™: Check out its capabilities and imagine your applications

The Basic Controller™ is a powerful, versatile and easy to use single board microcomputer system designed for control applications.

It is heavily into control I/O: relays, flags and sense inputs. What makes controlling these I/Os (and the external devices they control) so easy is our ZIBL™ (Z-80 Industrial Basic Language). It is a superset of NIBL, National Semiconductor's control BASIC, and was written by us specifically for control applications.

We've divided the control world into six categories: sense inputs, flag outputs, lites, relays, A/Ds and D/As. ZIBL implements 64 channels of each in such a way that you need not know anything more about them than their names.

In ZIBL it is valid to say:

100 IF TIME = 053010 AND SENSE (18) = 0 TURNON RELAY 5

Simple, isn't it!

Some but not all of the Basic Controller's mouth watering features include:

• File structures that allow multiple programs written in ZIBL to reside concurrently in RAM. Each program may be individually LOADed, RENAMEd, or RUN. Any program may access another program as through it were a subroutine, while still retaining its own line numbers and variables.

• Complete communication versatility. LISTing, PRINTing and INPUTing may be done to or from any serial or parallel I/O channel or the self-contained CRT I/O.

• Single key SAVE OR LOAD to and from cassette.

• Single key SAVE to EPROM. No worry about PROM addressing or programming routines, it is handled by ZIBL — automatically — even if there are other programs already in PROM.

• ZIBL in ROM: TURNON, TURNOFF, DELAY, TIME, REM, IF THEN, DO UNTIL, GOTO, GOSUB, @(exp), TRACE MODE, LINK, READ, DATA, DIR, RND(x,y), strings, triple precision integer arithmetic, plus the usual statements.

• Onboard: Z-80 MPU, 32 flags, 32 sense, 8 relays, 8 lites, 2 serial, 1 parallel, cassette I/O, 64x16 video, keyboard port, two 2716s with programming, up to 16k on-board RAM, up to 48k off-board RAM, real time clock, vectored interrupts, one kitchen sink, Lite Port on board, and an Expansion Bus.

$750 assembled, tested, warranted 1 year. You add power supply, keyboard and monitor. Available now — see your computer retailer.

4020 Fabian, Palo Alto, CA 94303; (415) 494-7817

DYNABYTE

CIRCLE INQUIRY NO. 18

it's a good bet the company you bought your computer from doesn't even make peripherals!

It's no great surprise! Most computer companies got their start in the digital logic end of the business. They were great at building calculators and later computers but when it came right down to it, most just didn't have the experience necessary to build the peripherals to support their computer products. And that left a vacuum!

At Heath we had the advantage. Our years of experience in electronic kit design gave us plenty of background with not only digital logic but mechanical and video design as well. And our assembly manuals and documentation are world-famous for easy to understand instructions.

We built the world's first digital color television, a unique fully synthesized FM tuner, digital frequency counters, clocks – even a digital bathroom scale.

So when we entered the personal computing market we had the "know-how" to build not only our outstanding H8 and H11, 8 and 16-bit computers, but, in addition, a complete line of supporting peripheral kits!

Select the H9 Video Terminal, the H10 Papertape Reader/Punch, and very soon our own, complete, Floppy Disk system. Each was designed with the systems approach in mind. Each was conceived to integrally mesh with not only our own computers, but through our set of sophisticated interfaces, most others as well. And in that way we're making every effort to fill the vacuum the others left!

So when you're ready to communicate with your computer turn to Heath. We've got the peripheral kits you'll need and at prices you can afford.

Maybe the company who sold you your computer didn't think about peripherals – but we sure did! And come to think about it maybe that's why you should come to Heath...in the first place.

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vance program. The Keynote Address will be given by Dr. C.A.R. Hoare, Oxford University, England. Among the 27 sessions to be held, are sessions on Microprocessor Software, Language Issues, Software Reliability, and Software Design.

To obtain a copy of the advance program and registration information, write to: Software Engineering, P.O. Box 639, Silver Spring, MD 20901.

SPECIAL TRAVEL SERVICE AVAILABLE TO NCC '78 ATTENDEES

A special, red-carpet NCC Travel Service has been established for the 1978 National Computer Conference to be held June 5-8 in Anahaim, California. The Travel Service, available only to NCC '78 attendees, offers savings on airfares of up to 44 percent in some cases. In addition, a toll-free number has been established for the Service. By calling 800/556-6882, attendees are assured of personalized service, including the lowest possible airfares. By acting now, the best possible arrangements whether you intend to fly to California alone, with colleagues, or with your family.

A variety of travel packages are available, depending upon days of the week, departure times, stopovers, and CAB regulations. Complete information covering available air travel packages from various cities, as well as a full explanation of regulations which apply to discount airfares, can be obtained by calling the NCC Travel Service toll-free.

There is no cancellation fee until tickets are issued, usually two weeks prior to departure. All major credit cards can be used and payments may be extended over 12 months. Arrangements for direct company billing can also be made.

NCC Travel Service personnel will be on hand at Los Angeles International Airport to provide assistance on arrival. In addition, a courtesy desk will be maintained at the Anaheim Convention Center to aid in handling reservation changes or in arranging for special tours of major attractions in Southern California.

HAMS GET TOGETHER

HAMFEST '78 will be held at the Plain City Fairgrounds, near Columbus, Ohio, on August 27.

If you would like to participate in this annual get-together of ham operators, contact Gene Kirby, 13613 U.S. 36, Marrysville, OH 43040.

US & UK TELECOMMUNICATIONS CONSULTANTS JOIN FORCES

International Communications Management, Inc. (San Francisco, New York) and Communications Studies and Planning Ltd. have formed an association to design and implement global telecommunications systems on both sides of the Atlantic.

Communications Studies and Planning Ltd.'s particular expertise in the areas of advanced telecommunications services, such as fast facsimile, will be available to United States organizations and manufacturers through ICM's offices. Conversely, International Communications Management's skill in implementing multi-country voice and message switching networks for United States firms will greatly augment CS and P's experience in European countries.

For further information contact International Communications Management, Inc., 680 Beach St., Wharfside Bldg., San Francisco, CA 94109, (415) 441-4100; Communications Studies and Planning, Ltd., Circus House, 21 Great Tichfield St., London, England, phone: 01-637-9757/8.

5-DAY SHORT COURSES

Integrated Computer Systems, Inc. has scheduled the following sequence of intensive microprocessor and microcomputer short courses which we believe will be of interest to computerists of all levels.

The weekly sequence of courses is as follows: Monday—Microprocessor Project Management: From Design through Manufacturer, QA and Field Service (#111); Tuesday—Microprocessor and Microcomputers: A Comprehensive Technical Introduction and Survey (#102s); Wednesday, Thursday and Friday — Hands-on Microcomputer Programming and Interfacing Workshop (For the Beginner) (#130).

The courses are being held nationwide in the spring of this year. The schedule of cities and dates is shown below.

Anaheim	May 1-5
Philadelphia	May 8-12
Washington, D.C.	May 15-19
Toronto	June 5-9
Boston	June 12-16
New York	June 19-23
Seattle	July 10-14
Dallas	July 24-28
Atlanta	July 31-August 4

Courses can be taken individually or in combination. Tuition costs range from $195 for a one-day course to $695 for the complete sequence.

For more information contact Integrated Computer Systems, Inc., 3304 Pico Blvd., P.O. Box 5339, Santa Monica, CA 90405, (213) 450-2060.

BATTELLE PROPOSES STUDY OF WORLDWIDE AIR CARGO FACTORS

Worldwide air cargo markets through 1985 will be forecast in a one-year study recently proposed by the Battelle research centers in Columbus, Ohio; Frankfurt, Germany; and Geneva, Switzerland.

Battelle will study the present and anticipated air cargo markets of the industrial world in Europe, North America, Japan, the Comecon countries, OPEC nations, and selected developing countries. The study will focus on relevant developments through 1985 and their consequences for the markets, structure, and profitability of the industries concerned. These include airlines, airports, aircraft and ground-equipment manufacturers, and forwarders.

The primary results of the proposed study will consist of forecasts of specific commodities shipped by all-freighter or belly-cargo air transport between selected pairs of countries. In support of these forecasts, the study is designed to identify the important changes expected to occur in international air cargo.

The study will examine the role of charter airlines, new price and tariff structures, motivations and requirements of shippers, new commodities amenable to air shipment; the demand for new aircraft and ground equipment, resulting from shifts in air cargo markets; factors that may impose unprecedented burdens on air transport, e.g. rising energy costs, traffic restrictions, and political influences; and the impact of deregulation of air cargo transportation in the U.S.

Results of the study will be presented to the clients in late 1978. Additional information may be obtained from C. William Hamilton, Battelle's Columbus Division, 505 King Ave., Columbus, OH 43201, (614) 424-5131.

FISHER-BROWNELL OPENS METER & INSTRUMENT DIVISION

Fisher-Brownell, an Avnet Company, has established a Meter and Instrument Division to serve the Northern California market, operating out of a new 200-square foot facility.

The function of the new M&I Division is to calibrate meters, modify face plates according to customer specifications, and to repair and recalibrate both analog and digital meters and instruments.

For more information contact Rick Hampton at Fisher-Brownell, 3381 Edward Ave., Santa Clara, CA 95050, (408) 988-6041.

MORE POWERFUL SPIRIT SYSTEM AVAILABLE FOR WHOLESALERS

NCR Corporation has announced a more powerful version of its SPIRIT system for wholesale distributors.

SPIRIT (Sales Processing Interactive Realtime Inventory Technique) is a customer-order-processing system originally introduced in 1974 for use with the NCR 8200 computer. With the on-line system, all data is entered using visual display terminals and customer and inventory files are updated immediately. Guided by instructions which appear on a display screen, the operator can inquire into information stored in the inventory, warehouse, customer and order files.

The enhanced version of SPIRIT includes new capabilities such as the remote printing of picking and packing slips, invoices, and customer and inventory-status reports. The enhanced version also has the ability to handle up to 40 visual display terminals when used with larger members of the NCR 8000 computer series or the NCR Century computer series. This means it can accommodate larger wholesale distributors with up to 16 warehouse locations.

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In addition, SuperTerm's unique "ballistic" printhead design is warranted for an entire year. This means that during the warranty period, should you ever encounter defects in printhead workmanship, Intertec will replace or repair the defective component *free!*

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End users will be pleased to learn that the Intertec SuperTerm provides all of this capability and more at a price of only $1995 — quantity one.

Low cost options available on every SuperTerm include: 200 CPS printing, super and subscripting, variable vertical pitch, pagination (automatic top of form), direct X/Y addressing, adjustable left and right margins, automatic reverse printing, double-width characters, automatic CR on end of line, a font programmable character set, and a 1200 baud communications package consisting of 120 CPS printing, dynamic buffer control, 202C interface compatibility (w/reverse channel) and automatic reverse printing.

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CIRCLE INQUIRY NO. 51

CALENDAR

May 1 Minnesota Computer Society will meet at the Brown Institute, Room 51, 3123 E. Lake Street, Minneapolis, MN. For further information contact the Society at Box 35317, Minneapolis, MN 55435, Attn: Jean Rice.

May 2 Tidewater Computer Club will hold its meeting at the Electronics Computer Programming Institute, Janaf Office Bldg., Janaf Shopping Center in Norfolk. The club also meets on the third Tuesday of the month. For further information contact: C. Dawson Yeomans, Interface Chairman, 677 Lord Dunmore Dr., Virginia Beach, VA 23462.

May 3 New England Computer Society will meet in the cafeteria of the MITRE Corp. at 7:00 P.M. Located on Route 62 in Bedford, MA. Contact Dave Day at (603) 434-4239 for details.

May 3 Kitchener Waterloo Microcomputer Club will meet at the University of Waterloo, Room 3388, Engineering Bldg. #4, University Ave., Waterloo, Ontario, Canada at 7:30 P.M.

May 3 Northwest Computer Society will meet in the Pacific Science Center in Seattle, Room 200 at 7:30 P.M. For more details write NCCN, Box 242, Renton, WA 98055.

May 3 The Valley Computer Club will meet at 7 P.M. at the Harvard School located at 3700 Coldwater Canyon, Studio City, CA.

May 3 Amateur Computer Society of Columbus will meet the first Wednesday of each month at the Center of Science and Industry at 7:30 P.M. For further information write c/o Fred Hatfield K8VDU, Computer Data Systems, 1372 Grandview Ave., Columbus, OH 43212, or call (614) 488-3347.

May 3 Lincoln Computer Club will hold its meeting at the South Branch Library located on 27th and South Sts. at 7 P.M. For more details write Hubert Paulson, Jr., 422 Dale Dr., Lincoln, NE 68510.

May 4 Bay Area Microprocessors Users Group (BAMUG) will meet in the Hayward ROC Center, 26316 Hesperian Blvd., Hayward, CA at 7:30 P.M. For further details write BAMUG, 1211 Santa Clara Avenue, Alameda, CA 94501.

May 5 Crescent City Computer Club will hold its meeting at the University of New Orleans, Lakefront Campus at 8 P.M. Call Bob Latham at (504) 722-6321 for more details.

May 6 Louisville Area Computer Club (LACE) will meet at the University of Louisville, Speed School Auditorium at 1 P.M. For details, write the club at 115 Edgemont Dr., New Alban, IN 47150.

May 6 The Computer Hobbyist Group, will meet at 1 P.M. in Green Center, Rm 2.530, of Univ. of Texas, Dallas. For details write to P.O. Box 11344, Grand Prairie, TX 75051.

May 6 South Central Kansas Amateur Computer Association, 9:00 A.M., Wichita Public Library, Wichita, KS. For further information call Chris Borger at (316) 265-1120 or Dave Rawson, 1825 Gary, Wichita, KS 67219, (316) 744-1629 for further details.

May 6 Oklahoma Computer Club will be meeting at the Belle Aisle Library at 10 A.M. Call Al Campbell at (405) 842-4933 for details.

May 6 Milwaukee Area Computer

Club will meet at 1 P.M. at the Waukesha County Technical Institute, New Berlin, WI. Call (414) 246-6634 for further details.

May 10 Homebrew Computer Club meeting will begin at 7 P.M. in Menlo Park, CA at the Stanford Linear Accelerator Center Auditorium. Call (415) 967-6754 for more details.

May 11 Mid America Computer Hobbyist meeting will be at 7:00 P.M. at Commercial Federal Savings & Loan, Bellevue, NE. Intersection of Galvin Rd. and U.S. Hwy. 73-75. Write P.O. Box 13303, Omaha, NE 68113 for more information.

May 11 Utah Computer Association will meet at Murray High School, Rm 154, 5440 S. State St., Salt Lake City, UT at 7 P.M. For details write or call Larry or Holly Barney, 1928 S. 2600 E., Salt Lake City, UT 84108. (801) 485-3476.

May 11 The Rochester Area Microcomputer Society will meet at the RIT Campus, Rm. 1030, Bldg. 9 at 7:30 P.M. For details write RAMS, P.O. Box D, Rochester, NY 14609.

May 11 North Florida Computer Society will meet at 227 Edison Dr., Pensacola, FL 32505. For information write this address or call Eugene Rhodes at (904) 453-3844.

May 12 Northern New Jersey Amateur Computer Club (NNJACC) will hold its meeting at the Fairleigh Dickenson University, on the Rutherford Campus, Becton Hall, Room B8, at 7 P.M. For details write NNJACC, 593 New York Ave., Lyndhurst, NJ 07071.

May 14 North Orange County Computer Club will have its meeting at Chapman College, Orange, CA. Doors open at 12:00. 105 Hashinger Hall Auditorium. Membership Chairman, Tracey Lerocker, (714) 998-8080 evenings.

May 16 Sacramento Microcomputer Users Group, (SMUG), 7:30-9:30 P.M. at SMUD Training Bldg., on 59 St. Write Richard Lerseth, P.O. Box 161513 or call (916) 381-0335 after 5:00 P.M.

May 16 Rhode Island Computer Hobbyists (RICH) meets the at the Knight Campus of Rhode Island Junior College in the Faculty Cafeteria at 7:30 P.M. For further information contact Emilio Iannucillo, RICH, P.O. Box 559, Bristol, RI 02809, or call (401) 253-5450.

May 19 Long Island Computer Association will meet at 7 PM at the New York Institute of Technology, Old Westbury Campus, Route 25A between Route 107 and Glen Cove Rd., Rm. 508. For more details write Long Island Computer Association, 36 Irene Lane East, Plainview, NY 11803.

May 19 Amateur Computer Group of New Jersey (ACGNJ) will meet at UCTI, 1776 Raritan Rd., Scotch Plains, NJ 07076 at 7 P.M. For further information write to the club at the above address.

May 20 Southern Nevada Personal Computing Society will meet at Clark County Community College, Las Vegas, NV at 12:00. The club also meets on the first Saturday of the month. For further information write SNPCS, 1405 Lucille St., Las Vegas, NV 89101 or call (702) 642-0212.

May 20 San Diego Computer Society will meet at the Grossmont Community College Student Center, 8800 Grossmont College Dr., El Cajon, CA. Doors open at 12:30. For details call (714) 565-1738.

May 20 The 7C's Committee (Affiliated with the Cleveland Digital Group) will meet at Cleveland State University Student Services Bldg., in the Kiva Room at 2:00 P.M. For more information write to Cleveland Digital Group, 8700 Harvard Ave., Cleveland, OH 44105.

May 20 Central Florida Computer

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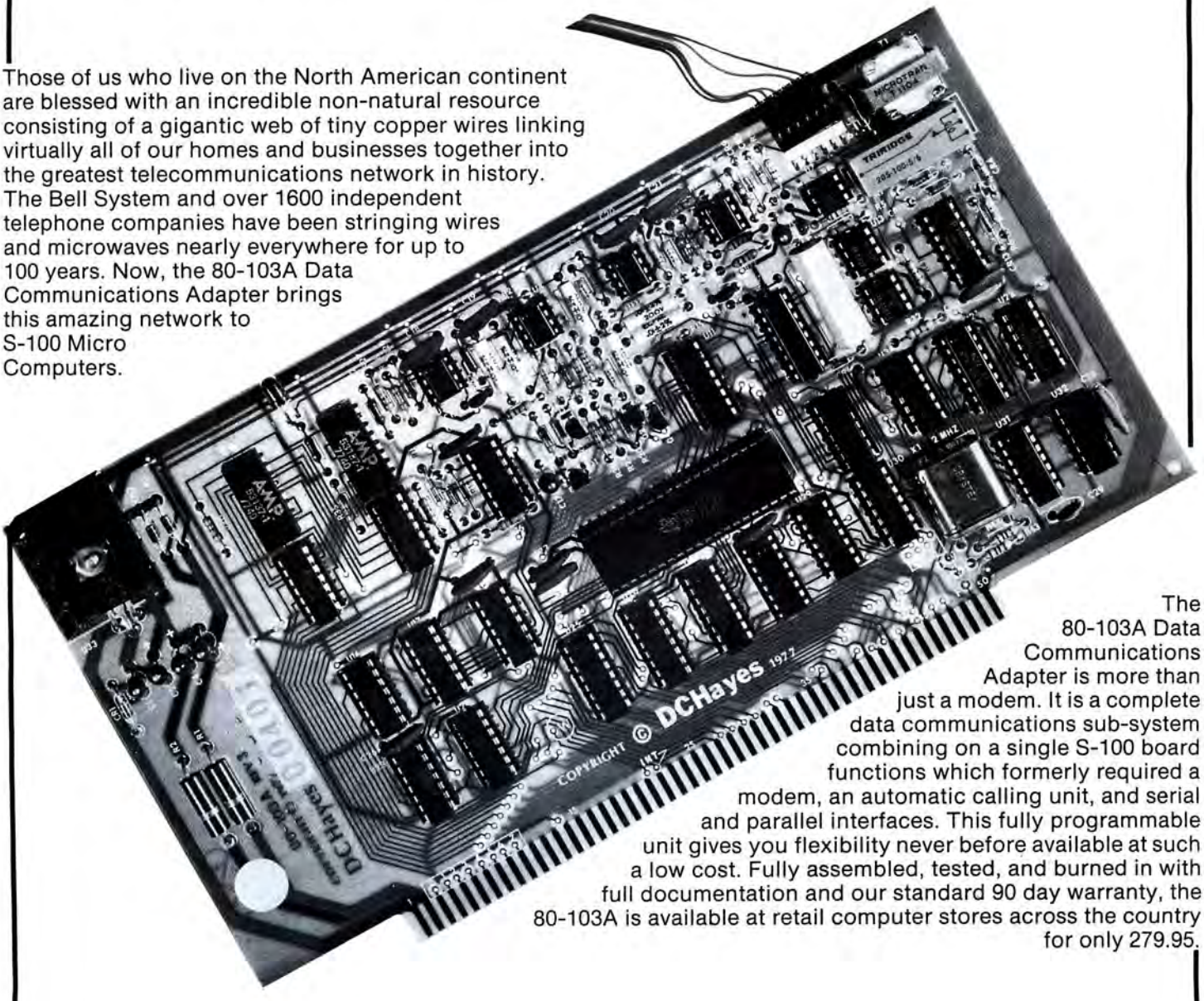

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Club will meet at the Orlando Utility Bldg., on S. Orange Ave., Orlando, FL at 2:00 P.M.

May 20 Philadelphia Area Computer Society will meet at 2 PM at LaSalle College Science Bldg. at the corner of 20th & Olney Ave. For more details write PACS, P.O. Box 1954, Philadelphia, PA 19105.

May 20 Computer Hobbyist Group of North Texas will meet at UTA University Hall, Rm 108 at 1 PM in Arlington, TX. For details call Neil Ferguson at (817) or (214) 265-9054.

May 24 Diablo Professional Users Group (DPUG) will meet at Diablo Valley College Library, near the Willow Pass exit of Fwy. 680, from 8-10 PM. For details write or call Bob Hendrickson, Electronics Dept., DVC, Pleasant Hill, CA 94523; (415) 687-8373.

May 24 Boston Computer Society will meet at the Commonwealth School, 151 Commonwealth Ave., Boston at 7 P.M. The school is located on the corner of Dartmouth St. in Boston's Back Bay. For information write or call the society at 17 Chestnut St., Boston, MA 02108, (617) 227-1399.

May 25 Space Coast Microcomputer Club will hold its meeting at 7:30 P.M. at the Merritt Island Library, Merritt Is., FL. Contact Ray Lockwood at (305) 452-2159 for details.

May 25 Small Computer Engineering Association of Minnesota (SCEAM) will meet at the Resource Access Center, 3010 Fourth Ave. So., Minneapolis, MN 55408 at 7 P.M. For more information write to this address or call (612) 824-6406.

May 25 Microcomputer Users Group (MCG) will hold its meeting at the University of Minnesota, Electrical Eng. Rm. 115 at 7 P.M. The club meets every Thursday. For more information write MCG, Dept. of Elec. Eng., 123 Church St. S.E., Minneapolis, MN 55455.

May 26 Alamo Computer Enthusiast meets at 7:30 P.M. in Room 104 at Chapman Graduate Center at Trinity University, San Antonio, TX. For details call (512) 532-2340, or write to the club at 7517 Jonquill, San Antonio, TX 78233.

May 26 Washington Amateur Computer Society has scheduled its meeting to be held at the Catholic University of America, St. Johns Hall. Located at Michigan and Harewood Aves. in Washington, D.C. Contact Bill Stewart at (202) 722-0210 for club details between the hours of 10 A.M. and 12 P.M.

May 26 TRACE will hold its meeting at the Ontario Science Center, 8 P.M., 770 Don Mills Road, Don Mills, Ontario. Club address is Box 545, Streetsville, Ontario, Canada L5M 2C1.

May 28 Summit City Computer Club will meet at the McMillen Library on the Indiana Institute of Technology Campus in Ft. Wayne, IN. For details write the club at P.O. Box 5096, Ft. Wayne, IN 46805.

May 28 Birmingham Microprocessor Group will meet at Southcentral Bell Company headquarters bldg. at 2 P.M. For further details write or call Jim Anderson, 2931 Balmoral Rd., Birmingham, AL 35223; (205) 897-9630.

May 30 Computer Amateurs of South Jersey will holds its meeting at the National Park Municipal Bldg., 7 So. Grove Ave., National Park, NJ at 7:30 P.M. For details call (609) 541-1010, or (609) 541-8296.

CALL FOR BUSINESS ORIENTED ARTICLES

INTERFACE AGE Magazine is seeking well-written articles related to the business world. These articles may cover any aspect of business as it relates to microcomputing.

Specifically, we would like articles describing hardware considerations for the small businessman. Software articles that present a useful application for any type of business activity.

Whether you are a doctor, lawyer, or candy butcher, if you use a microcomputer in your day to day business we want to hear about it.

Articles authored by individuals during leisure time are remunerated at a rate from $15.00 to $50.00 per published page and articles describing company projects carry author and company byline, but no honorarium is offered. Articles accepted will be acknowledged with a binder check within 30 days of receipt.

Manuscripts should be double-spaced, typewritten pages, one inch margins, and not less than 3½ pages in length (one published page). Pages should be numbered to insure correct text. Photographs should be numbered and labeled on the backside with a description. Photos should be taken with uniform lighting and background, in the form of glossy black and white prints. Tables, listings, etc., shall be on separate sheets. Computer listings shall be printed using a new ribbon to assure darkest print copy. Authors shall supply a statement of their background, expertise and level of accomplishment.

The publisher assumes no responsibility for artwork, photos, models, or manuscripts. Manuscripts are not acknowledged or returned unless accompanied by a self-addressed, stamped, return envelope.

For article submittal or more information, contact Carl Warren, Senior Editor, INTERFACE AGE Magazine, 16704 Marquardt Ave., Cerritos, CA 90701 or call (213) 926-9544.

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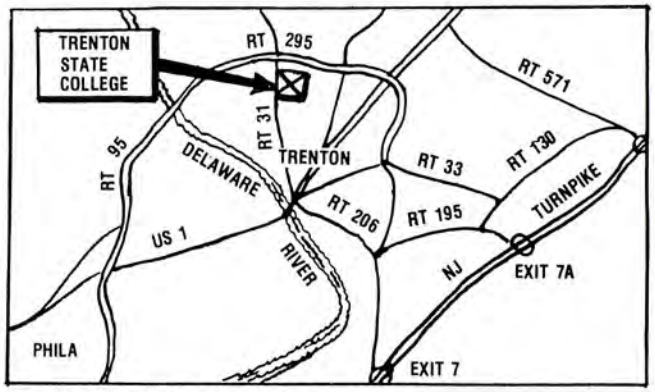

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By James S. White

Microcomputers are *potentially* more powerful than large computers, because they can *practically* do more things than can large computers. The truth of this easily misunderstood fact, sure to shake up several other comfortably accepted notions and ways of life, is based on the two terms *practically* and *potentially*.

Practically, microcomputers can do more because they cost less. Therefore they can be cost-effective in a much broader range of applications. The purpose of a business computer, in common with most other business tools, is to increase the bottom line figure or net profit. Therefore, the things that a business computer can be used for are determined by the cost-effect relationship. Small businesses have hundreds of functions which are adaptable to microcomputer automation, but never have been and probably never will be practical for large computers.

Microcomputers have many more uses* than are currently being offered, or suggested. Many of these *potential* applications need only a few years time to be developed and brought to market. (You won't have to wait the 15 to 25 years after hardware development that large computer users did.) New products are being announced every day, examples of which are in the New Products Section of this issue.

More significant than comparisons of power, speed, or interactiveness, is the understanding that microcomputers are just different than large computers. Consequently, comparing microcomputers and large computers is like saying that apples are worse than oranges because they don't have as much juice. Following such unequal comparisons, some people totally relegate microcomputers to an inferior status, and fail to gain many of their benefits.

The realization of the important potential of microcomputers will come when developers and users quit considering them as shrunken dinosaurs. Microcomputers are a different species, with their own unique characteristics. In some characteristics, such as processor speed and reliability, small computers (mini's and micro's), generally outrate the larger systems. In other characteristics, such as capability of traditional computing peripherals, microcomputers tend to fall behind. The real blossoming of the potential of microcomputers is waiting on their acceptance as themselves, not as little brothers.

Robotics is one start towards recognizing and applying some of the microcomputer's unique capabilities. Only a microcomputer, particularly those using the battery-powerable CMOS components, can provide practical control of a functional robot. Many other ideas concerning the use of microcomputers in robotic devices can be found elsewhere in this issue.

Perhaps, as a small businessman, you can't yet afford to add a robot to your staff. Anyway, you say, "What could a robot do for me?". Wait! —

*The word 'users' can be directly related to application design. Applications can be anything from payrolls to process control.

Robert's Rent-a-Robot has just introduced some interesting offerings for you! The stars of Star Wars, today's heroes of those who control much of America's spending (i.e., kids), are available to promote your products. A copy of R2-D2 can be rented for only $2.55 per hour (no FICA or unemployment taxes) to offer pizza samples, with cute lovable background noises, to your grocery's customers. Other robots are available for on-the-spot sales of oil in your self-service gasoline station, to beckon street traffic into your fast food service franchise, or to look over the shoulders of the school kids coveting the goodies in the aisles of your candy store. Okay, Robert's doesn't really exist today, but the possibilities do.

Another, more conventional, microcomputer application is the GEM Time Machine. Marketed by a real company (General Electronics Marketing Corporation, 207 Rhine Street, Watertown, WI 53094), this product was introduced at the January, 1978 Wisconsin State Bar convention in Milwaukee.

Basically a data collection system, the GEM Time Machine can be used by lawyers to record their office time spent working for each customer. When starting or finishing an activity, the lawyer keys, into his own personal terminal, data identifying the customer and type of activity. Other legal staff workers also key in identifications of what they have been or will be working on.

Using that data accumulated for any desired combination of project(s), worker(s), and/or client(s), reports of time and dollars accumulated can be obtained from the system at any time. Dollar rates can be those used for cost analysis, billing, or other purposes, can be different for each individual person, and can be calculated by the system (for example, by dividing a day's pay by the number of hours actually worked). Considerable flexibility is available to allow each report requester to determine the time and type-of-activity scope of his report, the amount of detail provided, and the media on which the report is presented. Automated invoicing is another possible end result. A large computer could do these jobs, but for unrealistically high costs. Hand methods have been affordable without providing now-possible accuracy, detail, and timeliness. This is a prime example of the cost effectiveness and practicality of a microcomputer application.

Law office timekeeping is probably not the most productive application for systems such as the GEM Time Machine. This system can have thousands of terminals, each different and each with as much or as little of its own computing power as desired by the user. One result could be a much more complete and flexible small business management information system, than now exists in many businesses. When well utilized, this capability could provide, to managers in a variety of industries, a completeness of objective knowledge and control which could revolutionize the management profession.

Present features of the GEM Time Machine are also only the beginning of those normally expected. Accounts payable, accounts receivable, general ledger, information retrieval, and word processing are being developed. These applications are important and practical for the legal profession, and use the same hardware used for time logging. Because this system includes a BASIC language, (which has several features, such as variable precision from 3 to 31 digits, and array with up to 15 subscripts), users can add their own application programs. The greatest benefits will be realized by the user who integrates these applications, using the multiprocessing capabilities of this and similar systems.

Another application example, which exemplifies the novel use of computers, is the use of a Wang computer to replace the entire crew for the 236-foot yacht Club Mediterranee, the second place winner in the 1976 OSTAR race between Plymouth, England, and Newport, Rhode Island. The only person aboard the yacht for the 25-day voyage was skipper and computer operator Alain Colas. The crew was programmed by Compagnie Internationale Service L'Informatique. The French nationality of both programmers and operator/skipper also provides an example of European computing expertise.

As a continuous watch stander, the computer's job was to monitor 24 instruments. The computer-integrated management information system was well designed to present only exception or requested information, rather than all the details that enthrall some users new to computers.

One instrument was a hygrometer, with the computer programmed to sound an alarm, (to awaken the sleeping skipper), whenever humidity approached a fog level. Another instrument produced a computer alarm whenever the Club Mediterranee received strong radar signals from another ship, a function particularly important because race rules prohibited active radar on all competing vessels. Other instruments checked for unacceptable course deviations, leaking propane or hydrogen, and for overcharge of batteries by the wind vane generator.

The computer-crew also performed data processing functions, such as calculating locations from sextant redings, and planning ideal courses, considering the earth's curvature. Morse code weather reports were also decoded and printed as received.

For those with landlocked businesses, or those just thawing out from a long deep winter, a yacht race may seem unrealistically distant. However, these three applications give examples of the potential power of microcomputers. Next month, a more precise look at microcomputer applications. □

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Micromation dealers are listed on the adjacent page. Check the list for dealer nearest you or ask at your favorite computer store.

*CP/M is a trademark of Digital Research

THE MIND REVOLUTION

By Merl Miller

In a way, this new column on artificial intelligence replaces "Programming the Human Computer" whenever an interesting subject comes up.

The primary purpose of this column is to exchange some information on artificial intelligence and, perhaps, start a dialogue on the philosophical, cognitional, procedural, mechanical and electronic aspects of artificial intelligence.

As background, you should know that I am a novice in this area. I am an industrial engineer with a little training in electronics and no formal training in computers. I publish books as a profession and study (and play with) computers as a hobby. What all this means is that any information I pass on to you is a layman's interpretation of what the experts think. Any opinions I express are mine and may have no basis in fact. If you think I am way off base, please feel free to tell me (and everyone else you know, if that's your bent).

Before we can talk about something being artificial, we have to what the "something" is. This gets a bit difficult when the "something" we're trying to do something to is intelligence. Webster defines intelligence as "the ability to learn or understand from experience; the ability to acquire and retain knowledge; the ability to respond quickly and successfully to a new situation . . ."[1] That should tell you something. I'm not sure what, but it does give us a starting point.

The first discovery you will make is that some of the people in this field are a little *different.* Not the least of these is Nels Winkless. Nels is a reformed magazine editor who now spends some of his time writing books. Being a confirmed layman, he sought the aid, assistance and general knowledge of robotics pioneer, Iben Browning. Together, they conspired on an excellent little book, ROBOTS ON YOUR DOORSTEP. Following are some of their observations on intelligence:

> "Human beings may be distinguished from rocks and trees largely by their superior intelligence. Rocks and trees seldom do anything surprising, even then their environments change sharply and danger threatens.
>
> If you approach a rock with a sledge hammer, making every visible indication of your intent to break the rock into small pieces so that it loses its identity completely, the rock does not react detectably to this bad news.
>
> A bystander may intercede with a woodman when he approaches a tree with an ax, but the tree itself makes no obvious protest to the proceedings.
>
> If the rock or the tree simply panicked and thrashed about, their chances of survival as entities would be improved, but they don't take any steps to avoid hazards. We regard them as highly unintelligent.
>
> The definition of intelligence is an arbitrary matter, and no definition of which we are aware satisfies more then a handful of interested parties at a time. Given a free hand, we define *intelligence* as:
>
> the ability to do something *appropriate* under unpredictable conditions
>
> Human beings do a great many appropriate, unpredictable things under circumstances that call for action to permit survival. We regard human beings as the most intelligent of the things with which we have any direct experience. In between people and rocks, we find a scalar assortment of things with varying degrees of intelligence."[2]

Okay, so you see their idea of intelligence; but how does that relate to computers? Try this:

> A computer may very well have sensors that give it contact with the outside world, thermometers, accelerometers, light sensors, microphones, what have you. These sensors funnel data to the computer's central processing unit, sometimes by way of filters, and preprocessors that strain out or collate data so that the CPU receives only comparatively high level stuff, and doesn't have to waste its time on trivia or irrelevancies.
>
> The computer compares this incoming stuff with information it has stored in its separate memory unit, sorting the incoming stuff for patterns.
>
> In effect, the CPU has input from both sensors and memory and it pumps out signals for action based on comparison of these sets of data.
>
> That's where the analogy with the human brain breaks down. The human brain seems to have no separate memory file. The original instructions for construction of the brain didn't call for building a compartment for data storae and didn't provide a file of data to store in such a compartment.
>
> Remember, the neurons are interconnected *randomly.* It is a hotly debated conjecture that *meaning* is acquired by the brain strictly from experience. That is, useful patterns of activity develop in the brain only because of experience acquired after its gross structural ordering and random structural detailing.
>
> Notice that some of the very large electronic integrated circuits are manufactured today by an analogous process. For example, a huge array of diodes may be laid out on a silicon chip, thousands upon thousands of them, all interconnected in every possible way. This array of diodes has no *meaning.* You can't use the massive array for doing work because everything is connected to everything else. However, chips containing all of these potentially useful components are placed in programming devices that convert them into distinctly different, useful circuits as desired. The programmer burns away a large number of connecting paths between components, leaving only a

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So, if you'd like more input on the Dumb Terminal Kit, just fill out the coupon and we'll send you complete, free information.

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Please make all checks and money orders payable to LeAnce & Reiser, OK?

Quantity and size(s) of shirt(s) required: ____S ____M ____L ____XL

Rush this application to: Dumb Terminal Fan Club Headquarters c/o LeAnce & Reiser, P.O. Box 17123, Irvine, CA 92714.

particular pattern of connections that tie the components together in a *meaningful* way.

The original chip has the potential of becoming whatever you want, within certain practical limits. You alter the original to meet requirements that make the effort worthwhile.

Not to belabor this . . . the brain is much the same. It's all wired up, ready to be used for something, anything. It has to *learn* how to respond in a practical way to sensory stimulus from the real world. Its greatest potential is when it knows least. It uses the potential up as it learns . . . but never saturates, as far as we know.

A baby is a *simulated* adult. Lucky thing.[3]

So far, we have defined intelligence and given some examples. But we still haven't explained it. This, then, is the essence of the problem: No one really understands just exactly what intelligence is. All we can really do is talk around it. But maybe by doing this we can learn to simulate it and create *thinking* machines.

Let's start by examining intelligent behavior. *Table I* shows four levels of intelligent behavior. These levels apply to any behavior, regardless of its origin, i.e., they apply equally well to a mouse, a human or a robot.

If you designed four robot mice to run through a maze, and each one had a different level of intelligent behavior, how would they run the maze? Mouse #1 (associative) would blunder through the maze until it reached the first barrier. It would then back up, turn and go straight ahead again until it got out of the maze.

You would give Mouse #2 (explicit) a set of simple rules to follow, i.e., always turn right when you reach a barrier. As long as your rules applied to the maze Mouse #2 was in, it would go through at a good pace. In fact, the better your rules and the more applicable they were to the problem, the better your mouse would do.

You would give Mouse #3 (formal) some idea about how to run the maze, let it practice on similar mazes and turn it loose. The more times it ran the maze, the better it would get, until it could run it in the shortest possible time.

Mouse #4 (nonformal) would analyze the maze, run it, and design a new maze.

This is, of course, a simplified version of what these different levels of intelligence represent. The problem with all of this is no one has yet figured out how to build a Mouse #4. Are we ever going to build a Mouse #4? Who knows? It is sure going to be fun trying.□

TABLE I
Four Levels of Intelligent Behavior

Level	Example of Capability	Characteristic	Program
Associative	maze problems; word-by word translation; recall games	repetition	list
Explicit	recognition of simple patterns, such as an OCR scanner; computable games, such as Nim, Tic-Tac-Toe or some versions of Star Trek	all meanings are explicit; i.e., they can't be altered by the situation; the program follows a set of rules	algorithm
Formal	chess, complex pattern searches	situation dependent; i.e., program learns by both example & practice	heuristic
Nonformal	creativity; problem solving	non-explicit meaning; i.e., adapts to the situation; learns by examining examples	none (yet!)

[1]Webster's New World Dictionary of the American Language, College Edition, New World Publishing Company
[2]Nels Winkless and Iben Browning, ROBOTS ON YOUR DOORSTEP, Robotics Press.
[3]Ibid.

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JURISPRUDENT COMPUTERIST

By Elliott MacLennan
Attorney-at-Law
Stephen Murtha

PATENTS, COPYRIGHTS AND TRADEMARKS

One of the areas the computer entrepreneur needs to understand is how business assets are protected by the law of patents, copyrights and trademarks. At one point or another, the businessman will either want to protect his own ideas, or to use someone else's. Whether or not he can, will depend on how this specialized body of law applies to his particular situation. Needless to say, the problems involved are complex, depend on each individual case, and require the specific advice of an attorney who specializes in these fields. The subject is too complicated for full coverage here, but this column will attempt to at least familiarize the reader with the terminology and basic concepts.

A patent is a grant from the government of the right to exclude others from making, using, or selling the patented device during a specified time; it constitutes a legitimate monopoly. In the U.S. a patent is granted for a term of 17 years. This term is nonrenewable.

To secure a patent, an application is filed with the Patent and Trademark Office. Full disclosure must be made. While the patent application is pending in the Patent Office, it is kept secret. Until a patent is actually issued, the person applying for a patent has no legal rights or recourse against infringement. If the Patent Office is notified of the infringement, the examination of the application can be accelerated, but there still may be considerable delay before a patent is issued.

To discourage infringements during this vulnerable period, the patented device can be marked with the words "patent pending" or their abbreviation. While this designation has no legal significance, it does put potential infringers on notice that a patent is being sought. Most companies will then think twice about copying the device, since it is impossible to tell when a patent protecting the device might actually issue. Conceivably, a patent could issue before the infringer got its device on the market, and all of the money spent on start-up costs would be jeopardized.

The requirements for patentability are that the device be useful, new and not obvious from what is already known in the art. Much difficulty is encountered in determining what is nonobvious. Patentability is decided in the first instance by the Patent Office when it decides to reject or to issue a patent, but its decision is subject to court review and federal courts have the authority to declare patents invalid. Enforcement of patents through litigation is complicated, expensive, time-consuming, and chancy, but a properly managed patent program can provide a decided competitive advantage, and constitutes an important business asset. Patents can serve as favorable tax vehicles for inventors, since royalties are taxed as capital gains.

Symbols have always been of great importance to man and some of the most important symbols in use today are trademarks. A trademark is a word, symbol, device, design or combination thereof, which is applied to one's goods, or their package, to indicate their source of origin. COCA-COLA, the GE emblem, MJB, TOYOTA, DEL MONTE, the Volkswagen emblem, RCA, KRAFT and PILLSBURY are but a few of the many well-known trademarks encountered almost every day. These trademarks, like every other trademark, tell us that the products bearing them were produced by the same concern that produced earlier products bearing the same mark. Thus, if we were satisfied with the earlier products we used, we know, by the recognition of the same trademark on subsequent products, that we can expect the same or similar quality in the later products.

It is a fundamental principle of the law that it does not protect ideas, methods, systems or principles, but rather the particular manner in which they are expressed. For this reason, two playrights can each copyright their respective plays, even though the. . .plot of both plays is the same.

In this way, trademarks become salesmen for the products of the trademark owner. If the trademarked products win wide acceptance with the consumer, the trademark becomes an extremely valuable business asset, since the mark represents the good will of the business. It can be used to pass onto new and untried products, the acceptance earned by the earlier products. In the case of a sale of the business to a new owner, the trademark can permit the new owner to enjoy public acceptance won by his predecessor through a continued use of the trademark. For this reason the purchase price of a business will almost always include the purchase of the trademarks and their good will.

Unlike patents, the acquisition of legally enforceable proprietary rights in a trademark are a do-it-yourself proposition. A trademark owner secures rights in a trademark by using it in commerce. If the mark is used in interstate commerce, it can then be registered with the U.S. Patent and Trademark Office. Registration provides the trademark owner with important advantages and should always be sought if a mark is used in interstate commerce, but registration is not a prerequisite to the protection of the trademark. Even in the absence of a federal registration, suite can be brought in court to enjoin an infringer. The test for infringement is whether the two marks, when applied to their respective goods, would be likely to cause confusion in the mind of purchasers.

Not every work, symbol or device can serve as a trademark. Any mark that is merely descriptive of the good will usually be understood by the consumer in its descriptive context and will not be recognized as an indicator of origin. Moreover, every competitor should have the right to describe his goods. If exclusive rights were given to descriptive words, legitimate description of the product could become highly circumscribed. Trademarks are registerable for a 20-year term that can be renewed as long as the mark continues to be used.

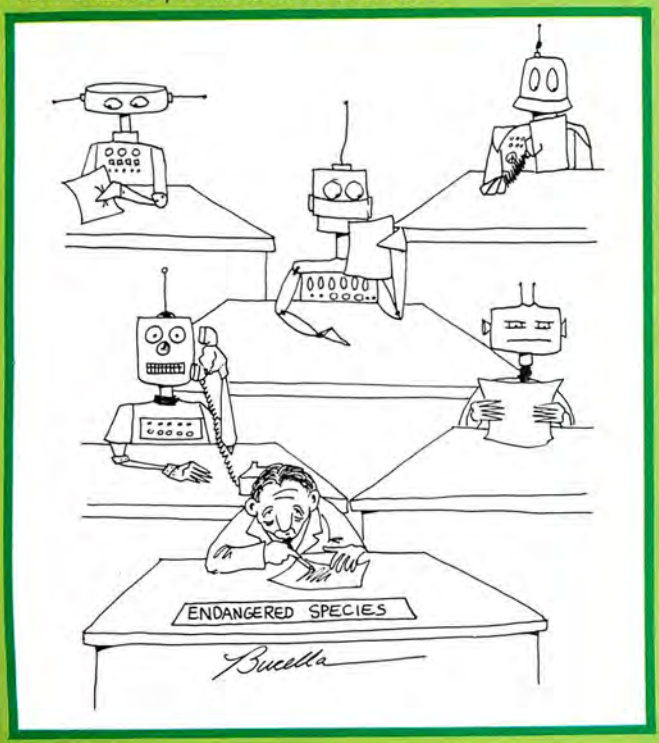
On January 1, 1978 a completely new copyright statute went into effect. The new statute is the first complete

revision of the law of copyright since 1909. Federal preemption is the most basic change effected by the new act. Under the former law, there was a dual form of protection: before publication the author held a copyright that was enforceable at common law; after publication his copyright was protected by federal statutory law. Now all works of an author embodied in a tangible form are protected by federal statute whether published or not. Only new works not reduced to tangible form, such as live choreography or a mime routine, would be protected under the common law.

The new copyright law protects all "original works of authorship" that are fixed in a tangible form sufficiently stable to permit the work to be perceived, reproduced or otherwise communicated for a period of more than transitory duration. In addition, the work must be the product of the author's own intellectual effort, as distinguished from merely being a copy of a pre-existing work. It is a fundamental principle of the law that it does not protect ideas, methods, systems or principles, but rather the particular manner in which they are expressed. For this reason, two playrights can each copyright their respective plays, even though the basic plot of both plays is the same.

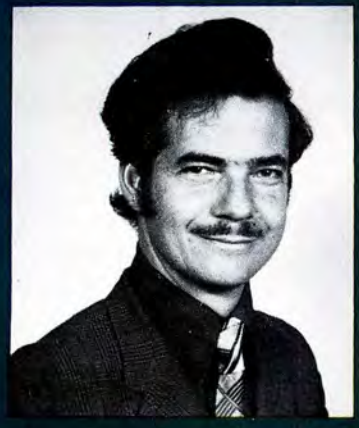
There are seven broad categories of copyrightable works. They are: literary works; musical works; dramatic works; pantomimes and choreographic works; pictorial, graphic and sculptural works; motion pictures and other audiovisual works; and sound recordings. Although computer programs are not specifically mentioned in the statutory listing of copyrightable matter, the definition of "literary works" as works expressed in "words, numbers, or other verbal or numerical symbols or indicia" would appear broad enough to include computer programs.

Under the new law, copyright is now an automatic consequence of authorship. Publication of the work, however, requires registration of the work with the Copyright Office, which is part of the Library of Congress. The term of copyright is for the life of the author plus 50 years. Works made for hire, which means works created by an employee or independent contractor on assignment, are considered to be authored by the employer, whether a corporation or natural person. The term for such works is 75 years from the first date of publication or 100 years from creation, whichever is shorter. □



. . . FROM THE FOUNTAINHEAD

By Adam Osborne



The responses I have received following my warnings against paying for goods in advance lead me to believe that a very serious problem exists within the microcomputer industry.

It seems to be the rule rather than the exception that companies big or small will hold your money for months at a time, and in a few cases they may never deliver anything. Moreover, a number of microcomputer hardware manufacturers, including some of the largest, are staying out of bankruptcy only by exercising day-to-day financial agility.

This whole industry could blow up in our faces, and none of us would want that. Let us therefore look at the problem and its solutions from the viewpoint of both customer and supplier.

You, the customer, have brought problems onto your head by ordering sight-unseen merchandise and paying with your order. What are you buying? Florida swampland? You must stop this practice immediately. There are exceptions. Bill Godbout, Newman Computer Exchange, Seals Electronics and SD Sales all have good reputations for either quickly filling orders or returning cash. (Other mail-order houses: send me the data to prove it, and I will add your names to the list in future columns.) Also, when you buy low-cost items you must frequently pay in advance, because it is simply too expensive for the seller to go chasing a bunch of unpaid $5.00 invoices. I believe our policy at Osborne & Associates is as fair as any. We require cash-on-delivery for orders of less than 10 books, because we have found that the cost of dunning for delinquent payments on small orders is usually equal to the entire profit for all small orders. When anyone sends pre-payment for a book that is not either in stock or at the printer, we send back the pre-payment. If anyone asks for their money back at any point before the books have been shipped, we immediately cancel the order and return the money. But why order directly from us, by mail, anyway? Our books are available at exactly the same price in any computer store, where you will obtain immediate delivery.

I propose the following set of guidelines for all pre-payments:

1) Never pre-pay or buy through the mail what you can buy at your local computer store.
2) Never, under any circumstances, pre-pay more than $150.00. The bookkeeping costs associated with these larger dollar amounts are not so horrible.
3) Expect to have your pre-payment held for a maximum of 45 days. However small the pre-payment, you should demand and receive a complete refund after 45 days.

Let us now look at some of the arguments manufacturers put forward when they demand pre-payment.

Many companies say they will not accept your order without pre-payment. Fall for that one, and you have given the supplier a long-term, interest-free loan with no guarantee of repayment.

Companies argue that by pre-paying, you get yourself ahead in the line for early delivery. In a few cases that may be true, but in most cases paying in advance puts you at the end of the line. When the supplier finally has a few products to ship and is strapped for cash, whom do you think will get the first shipment? You, who have already paid and will do their cash flow no good, or the next customer, who did not pay, but will now take delivery ahead of you and provide some badly needed cash? It is a safe bet to assume that by paying in advance you get yourself at the tail-end of the delivery schedule, behind customers who will pay cash-on-delivery.

Paying cash in advance is supposed to guarantee that you are getting the most recent products. It also guarantees that you will be the guinea pig who finds the design errors in products which were delivered early. You also stand a sporting chance of finishing up with the odd-ball version that has poor resale value. Your wisest policy should be to buy nothing unless it has been on the market for six months to a year and is readily available in computer stores. Then you will buy products that exist — and work. Being the first on the block with a new piece of computer hardware does not show how resourceful you are; rather, it shows how stupid you are.

Customers, confine all of your business to your local computer store. Computer stores are set up to take risks with deliveries; part of the hazard of running a computer store is in dealing with manufacturers. If all end-users would buy only through computer stores, and then buy only what they had seen on display—and working—our whole industry would be in much better shape.

Turning now to manufacturers, if everyone immediately stops paying cash with their orders, where will that leave the manufacturers? Financially, it leaves them in very bad shape. But, that may in the end be for the best, since the present habit of cashing customers' checks in order to build the product (which was supposed to be ready) is a financial time bomb. Ultimately the bomb is

Branched to Page 57

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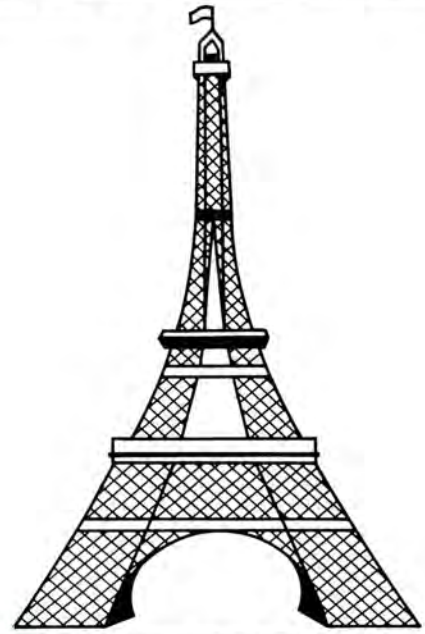

INTERFACE

By Hans Drewitz and Roland Hesse

The microcomputing revolution has not really been felt in Europe. However, we are beginning to see the first indicators. Microcomputing articles are appearing in local newspapers and general interest magazines. The tone of these articles is very similar to the type seen in the United States in the summer of 1976. Apparently, the public is becoming more and more interested in the microcomputer.

This general public interest in micros has caused the European retailing industry to prepare to pursue the rising market. The larger department stores in Europe are planning to market many of the new devices. Computer stores are just becoming a part of the retailing scene.

The European press is taking an active part in this revolution. Journalists are making every effort to understand what is happening, and are trying to determine why people buy the machines. The press is also addressing the application end of the market, by asking what the public will use the micro for.

The only element missing is a personal computing fair similar to the Atlantic City show held in 1976. Exhibitions of this type are probably not far off, and will do much to influence the micro's prominence in the European market place.

U.S. manufacturers are starting to take an active interest in the European market potential. IMSAI, which began its European sales in Frankfurt, has moved to Luxemburg, and created the IMSAI European Corporation. The IEC is providing dealers with both sales and technical support.

Pertec/MITS, is not forgetting Europe either. They are in the process of establishing a number of dealerships in the major countries of Europe. The MITS people do have the reputation, in Europe, of providing excellent software and everyone is anxious for their timesharing system.

APPLE is also establishing a dealer network in Europe. The APPLE will probably enjoy an excellent share of the European market, because of their innovative systems approach.

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Although the interest in personal computers is rising, and both European and U.S. manufacturers are addressing the market, the micro in Europe is geared more to the professional user.

Small businesses, less than ten employees, are starting to realize the possibilities of automating using the microcomputer. New businessmen who have developed an interest in the machines, and the expertise in BASIC and other languages, are more aware of the micro's possibilities than older more established businessmen.

The company, however, that wants to do business with representatives or dealers in Europe has to consider certain procedures.

As in the United States, the small business user in Europe is looking for total integrated systems. Total software and hardware support is expected, and was confirmed at the System 77 exhibition held in Munich.

The personal use of the microcomputer is significantly less in Europe than the U.S. This is primarily due to the cost of the systems, after tax, freight and import duties are added. Hopefully, with the influx of American manufacturers into the European market, prices will lower.

EXPORT/IMPORT PROCEDURES

Shipping one or two boards to Europe is, in general, not a big problem. The company, however, that wants to do business with representatives or dealers in Europe has to consider certain procedures. Computer equipment requires an export license which has to be granted by the U.S. Department of Commerce. In order to obtain this license, the following supporting documents are required: The first document is referred to as the Internatinal Import Certificate. This document has to be completed by the partner in Europe. In order to him to obtain this certificate, the U.S. partner has to provide him with a proforma invoice. The proforma invoice should use:

- a general description like "Digital Microcomputer Equipment and Peripherals"
- an average unit price
- a quantity which is the expected business for one year.

With this invoice the European partner should now be able to obtain a completed and approved International Import Certificate from local authorities.

The second document is the application for export license, which has to be completed by the U.S. partner. This procedure is valid for: Austria, Belgium, Denmark, Federal Republic of Germany, France, Greece, Italy, Luxemburg, Netherlands, Norway, Portugal, Turkey and the United Kingdom. For Switzerland and Yugoslavia the procedure is similar. The only difference, however, is that instead of the International Import Certificate, the European partners have to obtain:

- for Switzerland — a Swiss Blue Import Certificate
- for Yugoslavia — a Yugoslav End-Use Certificate

For countries not listed, an Internal Import Certificate is not required. Instead there is a document called *Statement by Ultimate Consignee and Purchaser.* This form has to be completed and signed by the partner in Europe

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and the partner in the U.S. The U.S. forms can be obtained from the U.S. Department of Commerce in Washington, or the District Offices of the US Department of Commerce. In California there are offices in Los Angeles and San Francisco. Other states have at least one. An application for an export license takes about 30 days. Considering all time involved, it takes about two months before shipping can start.

EURO COMPUTER SHOP PARIS

Where does someone go who is looking to buy a microcomputer system in Paris? His possibilities are COMPUTER BOUTIQUE, several APPLE distributors, MBC—a French manufacturer promoting a system called ALCYANE, or Euro Computer Shop Paris.

ECS Paris was started in late 1976 as an attempt to provide microcomputer hardware, and U.S.-developed software, to the small community of amateurs in Paris and in France. Driven by the requirements of the market, the business direction of ECS Paris changed towards marketing integrated microcomputer systems to small enterprises and schools. ECS Paris acts as the independent consultant in questions of data processing for their clients. ECS Paris offers SYSTEM/ZERO, claiming it to be the lowest-cost general purpose microcomputer system available for commercial and technical applications. SYSTEM/ZERO is based on an IMSAI mainframe, North Star floppy disks, and completed with standard business software.

The shop is stressing the ease of computer use, and has developed their own system software for that purpose. ECS Paris also functions as a mail order house for all microcomputerware, closely cooperating with a partner in the US. The shop provides after-sales services in a partnership with REPTEC Paris, the iCOM and PERTEC distributor for France.

Since December 1977, the business has been run by two former IBM product managers. Euro Computer Shop Paris is a computer shop with an absolute professional approach. It is located in Paris-Boulogne, 16, rue Louis Pasteur and is open Monday through Friday from 9 am to 6 pm and Saturday by appointment. □

FROM THE FOUNTAINHEAD

Vectored from Page 50

going to explode; the only question is when.

Manufacturers can get themselves out of this dilemma by obtaining adequate capital in order to run their businesses. Right now, there is plenty of capital available. I receive more telephone calls from people who would like to invest in microcomputer hardware manufacturing companies than I receive from microcomputer hardware manufacturers seeking investment cash. Manufacturers are greedy. They want the whole barrel of apples for themselves. My question is this: Are you better off owning a whole barrel of rotten apples, or would you prefer to own a portion of a barrel of good apples? If you are a manufacturer currently raging at this column for suggesting policies that will drive you into financial ruin, then stop a minute and try to think of me as your friend. The money is out there to turn your company into a viable enterprise which you will control (if you know how). You will own a piece of it, but not all of it. Do you need financial investments in your company? If you do, call me at (415) 548-2805. Do you have cash you would like to invest in someone's company? If so, call me at the same number.

Let us get our industry into reasonable shape. Most manufacturers are not crooks, they just do not have enough money to run an honest operation. □

SENSE LINE

By Dick Moberg
President, Philadelphia Area Computer Society

The Philadelphia Area Computer Society, (PACS), is not the oldest computer club, it's not the largest club, and it's probably not that well known outside the Northeast (yet!). But we are a fast-growing, fun-loving group of computer hobbyists, right in the middle of an area buzzing with computer activity. Philadelphia, after all, is where it all began. The world's first all-electronic digital computer, the ENIAC, sits quietly now at the University of Pennsylvania, just down the hall from where our club mailing labels are processed on their new and busy Univac 70/90.

PACS, a little less than two years old, has over 250 members, meets monthly, publishes a monthly newsletter, and has regular subgroup meetings and tutorial sessions. As a group we are actively engaged in setting up a microcomputer network system; we sponsor a Computer Game Festival, and co-sponsor the fabulous Trenton Computer Festival. We are well established, have a good meeting format and location, and, most importantly, we are growing fast! How did we get where we are? It took a lot of work and probably an equal amount of mistakes. So that others might learn from our experience (the purpose of Sense Line), we will look into some of the details of what makes PACS run, and why.

A CLUB IS BORN

Early in 1974, I met up with a man named Karl Amatneek, while we were both working at Hahnemann Hospital; he as a logic designer and bioengineer, and myself as a programmer, animal surgeon, and grad student. Karl was amazed by these new-fangled microprocessors and took it upon himself to teach other engineers about these "goodies" (he hasn't stopped teaching since them). At any rate within an hour of first meeting each other, I was thoroughly bitten by the microcomputer bug (and was talked into helping arrange a one-day tutorial on the Intel 4004).

The tutorial was so successful they had to turn people away because there were only 200 seats in the auditorium. So the excitement was starting to build way back then.

In the months that followed, I was "turned on" to the hobbyist literature (what little there was), by a friend, Dr. George Haller, a retired General Electric Vice-President and early microprocessor user. After visiting him once, I ended up subscribing to all the microcomputer magazines: Micro-8, People's Computer Company, and ECS, a monthly how-to-build-it put out by then little-known Carl Helmers.

Later that year (1975), when ECS turned into Byte Magazine, I thought it would be nice to get together with other computer hobbyists around the city; especially since I knew my half-finished 8080 system would never be completed without some divine intervention. So I sent a letter to Byte asking interested people to contact me. Shortly thereafter, I also made an announcement at Karl's latest tutorial. Needless to say, I was inundated with phone calls after the Byte letter appeared.

During all the commotion I heard that Philadelphia already had two computer stores. One of them, Personal Computer Corporation, offered us a meeting place. I then sent out 200 notices to people whose names I had collected and on June 6, 1976, 75 people gathered to "talk computers." Thus PACS was born.

THE EARLY DAYS

Our first priority was to start a newsletter, which we did promptly, and had it in the mail before the next meeting. The Data Bus, as we called it, now has grown to 16 pages and contains meeting information, feature articles, tutorials, classified ads, and other items useful to the computer amateur. Classified ads are free to members and our paid ads just about cover the printing costs. We decided on dues of $10.00 ($5.00 for students).

Our early meetings regularly drew 60 to 80 people, and were usually product or homebrew demonstrations. It was hard to find out what the members wanted out of a meeting, probably because they didn't know themselves. It seemed as long as we provided lots of time for informal gatherings, they were satisfied. It wasn't until about a year later that we hit upon a workable meeting format. As far as a meeting location, we quickly came into contact with Dr. Steve Longo of the LaSalle College Physics Department. He wanted to learn about microprocessors as much as we wanted to use his auditorium, surrounding lab, and classroom space. We met there at our third meeting, and it's been a happy marriage ever since then.

PACS TODAY

Every club has its own personality, and if I were to describe PACS in one word, it would be "education." Our education chairman, Jon Bondy, from General Electric's Valley Forge Space Center, has put together a course list that looks like a university catalog. Furthermore, we have been blessed with some very dedicated and talented instructors. Courses are free to members and the content and reading assignments are printed in the newsletter prior to the meeting. A sampling of our course roster is as follows: Digital logic design, A/D conversion techniques, 6502 basics, S-100 bus fundamentals, structured programming, PASCAL, Selectric typewriter interfacing, and many more. Most of them continue for three to five months and then are "recycled."

PACS meetings are on the third Saturday of each month. Though the main presentation doesn't start until 2:00 p.m., the doors open at 11:30 a.m. for subgroup meetings and two sets of courses. We have found it wise to keep the main meeting topic of general interest, such as our recent demonstration of the Apple II computer. Anything of a highly technical nature we do as a course or workshop. After the meeting, we have a "mapping session" where people in the audience can stand up and say anything (I need this, I want to sell that, I heard a rumor that . . .) for 30 seconds or so. Then, when the formal meeting is over, people can make the necessary contacts for the remaining "gab session." Flea market items are brought in for sale during the gab session.

THE SNOWSTORM

Our only meeting cancellation came when the "Great Northeast Snowstorm" hit the night before the January meeting, dumping more snow on Philadelphia than it had seen in several decades. Even so, I was hesitant to cancel the meeting until I learned that the computer to be demonstrated was stuck in the snow somewhere between New York and Philadelphia. The next problem was *how* to cancel the meeting. We had worked out a phone system a year ago where, between the officers, all the members could be called. But a year ago membership was 50, not 250. The best I could do was to call radio stations and sit by the phone for several hours prior to the meeting. That evening, though, I had calls from

several members expressing their disappointment at the cancellation. Several had shoveled out their card just for the meeting, and others were coming via cross country skis. It was heart-warming to say the least.

PACS HOTLINE IS BORN

Needless to say, the club needed a better means of quick communications. So, within a week I had another phone installed, a phone answering machine was donated by a club member, and the PACS Hotline began! We now have a recording with meeting information, the PACS address, and a few minutes at the end for computer bargains from some of Philadelphia's great surplus stores. These ads at the end of our message more than pay for our phone bill. Our Hotline number is (215) 925-5264 for anyone wishing to call.

. . .PACS is not the oldest computer club, it's not the largest club, and it's probably not that well-known outside the Northeast . . . But we are a fast-growing, fun-loving group of computer hobbyists . . . we are actively engaged in setting up a microcomputer network system. . .

THE MANY PERSONALITIES OF PACS

Although PACS, for the most part, is made up of engineers, programmers, and students, we have members who are accountants, travel agents, printers, attorneys, and many others, each with an interest in computers for fun or for use in their business. Also, PACS has more than its share of microcomputer stars. One of the most outstanding is Will Mathys of MOS Technology, who is almost single-handedly responsible for the design of the 6502 microprocessor. Having Will and MOS Technology so close has led to our group being saturated with 6502 users and applications.

Two groups of members have actually designed 6502-based products which are now nationally advertised. Bill Goble, the S-100 wizard (see INTERFACE AGE, June 1977), together with Joe Swope, Bill Redka, and Ed Chien, started CGRS Microtech and have developed the only 6502 CPU card which is directly S-100 compatible. They now have a complete system with CPU, motherboard, DMA front panel, and I/O card featuring the 6530 TIM teletype monitor.

Another group, Carmen DiCamillo and Roland James, designed a 6502 tutorial board called the DATAC 1000, which has been used to teach microcomputer concepts to several hundred engineers in this area through local IEEE tutorials. The board is a single-board computer system with CPU, memory, and a cassette tape or TTY I/O. It can be programmed in machine language using their unique "touch pad" binary switches.

Both DATAC and CGRS have been more than helpful to the club. Carmen and Roland are in the middle of conducting a 6502 tutorial based on their board and CGRS recently held an S-100 workshop where members brought in their defective S-100 boards and Bill and Joe showed them how to repair them.

Let's Get Personal in Anaheim

June 6-8, 1978

A rewarding personal experience is in store for you June 6-8 at the NCC '78 Personal Computing Festival... the most comprehensive personal computing event ever held. The Festival, a separate feature of the National Computer Conference, will include approximately 30 program sessions, commercial exhibits of consumer computing products and services, plus a contest and exhibit of microprocessor systems and applications. All Festival activities will take place in the Disneyland Hotel Complex, just a few minutes from the Anaheim Convention Center, site of this year's NCC.

Plan now to attend the big, new NCC '78 Personal Computing Festival. The program will include special paper, panel, and tutorial sessions on such topics as speech synthesis and recognition, computerized music systems, hardware and software design, computer graphics, and small business systems. All papers will be published in a softbound volume, *Festival Digest '78*, which will be available during NCC.

Festival exhibits will provide an extensive display of commercial offerings by organizations serving the personal computing field. More than 100 companies, occupying over 175 booths, will display systems, components, terminals, software, kits, disc and tape cassettes, relevant publications, and related hobby items.

Rounding out the Festival will be a contest featuring microprocessor systems, devices, and applications ranging from home-brew DOS and graphics terminals to educational applications and computer games. Prizes will be awarded for the best exhibits.

Don't miss the year's most exciting personal computing event. For more information, return the coupon or call AFIPS at 201/391-9810.

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CIRCLE INQUIRY NO. 2

Some other personalities in the area are the Mauchleys and the Eckerts, designers of the ENIAC. Ted Nelson (author of Computer Lib) hibernates at nearby Swarthmore College, as does Dr. Kenneth Iverson (inventor of APL). Also a member is Rick Simpson (the PET and KIM-1 king). And last, but not least, are those far-out space cadets from 2005 AD (see INTERFACE AGE, February 1978), whose "walletsize" space flight simulator was the hit of the Personal Computing 77 in Atlantic City last year!

FRIENDS OF PACS

We have been very fortunate to have Sol Libes of the Amateur Computer Group of New Jersey (see Sense Line, January 1978), so close to us. Sol has been an inspiration to many club leaders and has helped our group considerably by letting us co-sponsor (and share in the profits of) the Trenton Computer Festival.

To the east of us is John Dilkes, promoter of Personal Computing '78. It's reassuring to know that although John is now promoting one of the largest computer shows, he is still one of us, an amateur computer hobbyist. At the show in Atlantic City last year, John gave PACS a booth and a hospitality suite, which was shared by several area clubs. We about doubled our membership at the show, and our tired members made good use of the hospitality suite. PACS plans to sponsor an event at Personal Computing '78, this year to be held in Philadelphia.

In closing, I think a few words about the future of PACS are in order. First, we are at a size where we need to incorporate and apply for our non-profit educational status. Some clubs (ourselves included) have had trouble obtaining non-profit status and, perhaps this problem could be solved by a "how-to" article for one of the computer magazines or by the "association of clubs" that is being formed. PACS is sponsoring a Computer Game Festival, which is our first attempt as a group to show the area what microcomputers can do. Hopefully, it will evolve into an annual applications show for the immediate area. We hope to get our club network going soon, to facilitate communications and software exchange. But whatever we are doing in the future, I'm sure of one thing, we'll be having fun.

If any groups would like to exchange newsletters, or keep in touch with PACS, write to: PACS, P.O. Box 1954, Philadelphia, PA 19105.□

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Features in This Section

ROBOTICS EDITORIAL

By Sandi McKeen, Assistant Editor

In April of 1977, INTERFACE AGE took an introductory glimpse at the fascinating subject of Robotics — from the whimsical concept of robots as pets, to the practical assumption of household chores such as vacuuming and carrying parcels.

Now it's time to again look at the state-of-the-art, or rather science.

We are a long way from the scene envisioned by Ray Bradbury in his delightful poem "Where Robot Mice and Robot Men Run Round in Robot Towns," or the thinking, feeling robots R2D2 and C3PO of Star Wars, with their humanistic foibles.

But robots and robotic devices are already making valuable contributions.

In this issue we will consider some of these applications, as well as the present level of technological development, and what to expect in the future.

Robots have been with us for some time — whetehr as primitive mechanical toys or existing purely in the imaginations of futuristic writers.

But with the advent of the minicomputer, the technological means are now at hand.

At this point, let's define just what is meant by the term robot. Generally, a robot is conceptualized as having an anthropomorphic form, mobile, computer directed to perform various tasks, and possesses the ability to react to its environment.

Some, such as Quasar Industries' Klatu, or Robbie and Gronk built by Keith Paul and John Hughes, are already operational. Others, such as a paramedic robot for hospitals, or a security-guard robot, will be available in several years.

Although less spectacular, robots or, more correctly, robotic devices can be utilized in manufacturing to perform a variety of jobs considered as undesirable, either because of their boring, repetitious nature, or because they present a hazard to a human worker. Such routine jobs as spot-welding, drilling and assembly can be assigned to robotic devices.

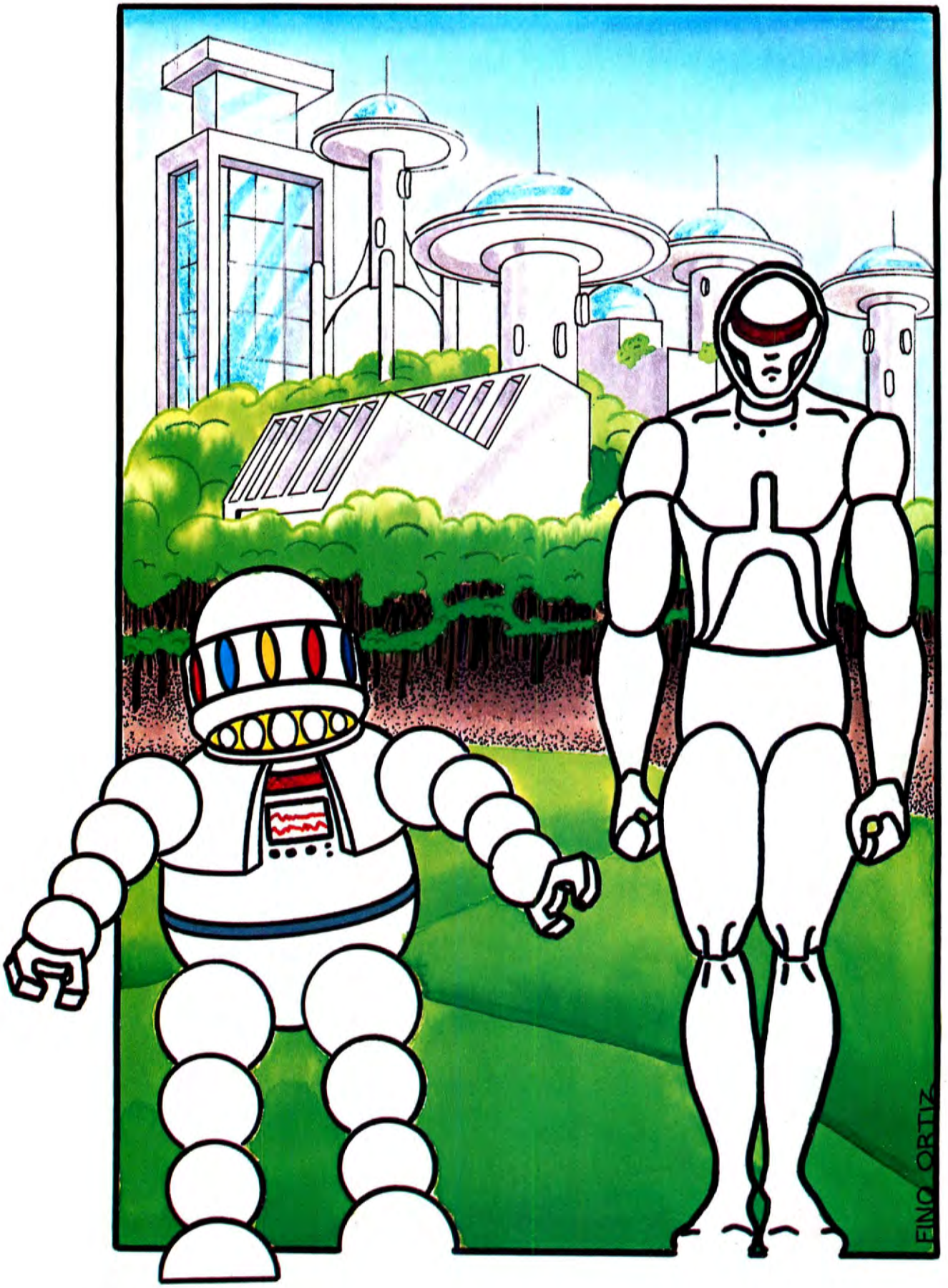
Just what's to come? One chief requisite for progress is the ability of the robot to learn from experience — rather than to react in a repetitious trial-and-error pattern. Another, providing robots with vision by utilizing black and white television cameras, coordinating "hand and eye movement." And finally, the ability to respond to, and reply in, a verbal mode.

As you can see, we are a long way from developing a robot with the characteristics of an R2D2, but we're getting there! □

Where Robot Mice And Robot Men Run Round In Robot Towns

By Ray Bradbury

They asked me where I'd choose to run, which favored? Ups? or Downs?
Where robot mice and men, I said, run round in robot towns.
But is that wise? for tin's a fool and iron has no thought!
Computer mice can find me facts and teach me what I'm not.
But robot all inhuman is, all's sin with cog and mesh.
Not if we teach the good stuff in, so *it* can teach our flesh.
There's nothing wrong with metal-men that better dreams can't chalk.
I'd find me robot-Plato's cave if he lived on my block;
And though his eyes electric were, computerized his tongue,
Is that more wrong than Berlioz on LPs harped and sung?
So much electric fills our lives, some bad, some good, some ill.
But look! there Shaw and Shakespeare dance on Channel 7's sill:
A gift of hearts and minds and eyes to see our dark/light face,
To weigh and balance halos/blights that half-destroy our race;
To midget make our rocket-ships, and squeeze grand Kong down small
Then Giants grow from Shavian seed to taunt, provoke us all.
As man himself a mixture is, rambunctious paradox,
So we must teach our mad machines: stand tall, pull up your socks!
Come run with me, while children/men, half dires and dooms, half clowns.
Pace robot mice, race robot men, win-lose in robot towns.


EINO ORTIZ

The History of Robots

By Forest J. Ackerman

This article is excerpted from a record made by the author. Consequently, to enjoy it to its utmost, turn off all the lights but one, sit back in your easy chair and read. As you read, you will find yourself being taken on a fantastic journey into the world of robots.

—Editor

Hello, this is Forrest Ackerman, Editor of *Famous Monsters of Filmland and Spacemen.* I've heard from thousands and thousands of you fans since the world's original film monster magazine began in 1958, and many's the time I wished that I was the beast with a million eyes — in order to read all your letters quicker. Well, having heard from all of you, it seems only fair — doesn't it — that you should hear from all of me.

As you probably guessed, I'm Doctor Ackula and Karlon Torgosi and his sister Vespertina. (Vespertina is the Transylvanian word for bat.) I'm also Weaver Wright and Spencer Strong and a long list of other names, including Mechanical Man and Robot Mitchum.

I've been interested in robots for about 35 years and as a boy of ten, I had the thrilling experience of seeing the great film masterpiece "Metropolis" when it was brand new. It was a silent picture produced in the mid-twenties and the most unforgettable scene was when the robot was animated. When that smooth, streamlined mechanical humanoid figure was commanded to rise by Rotwang, its creator, and slowly, ever so slowly, an inch at a time, almost like Im-ho-tep, the Egyptian mummy dead 3700 years, the robot moved and came to life. You could almost hear the whirring as Rotwang, his artificial hand covered with a black leather glove, ordered his robotrix — it was in female form, you see — to rise from her chair and present her cold, steel hand to John Masterman, the master of Metropolis — the greatest city on earth in the year 2026. Twenty Twenty-six, hmm. Come to think of it, that's quite a few years yet.

Do you suppose we'll have to wait that long to see real robots? I doubt it. Actually, already the robots are among us. And that's the title of a fascinating book by Rolf Strehl. He says that, fantastic as it may seem, the time may one day come when the man on the streets may be as rare a sight as a horse is today.

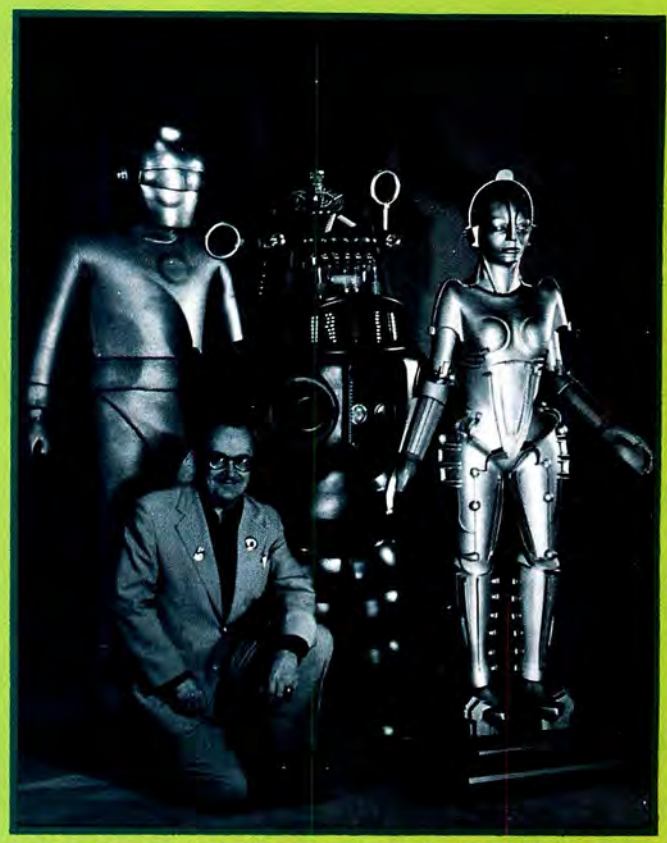
Robot chess players may not seem very alarming, Mr. Strehl says, and electronic calculators that can perform in a minute the work of ten men laboring ceaselessly for a hundred years are an obvious advantage. But what of the robot spy? The guided missile with its atomic warhead satellite eyes in the skies.

The disturbing incident of the robot that ran amuck and Frankenstein-like murdered its creator. Of lengendary origin is our first information about the artificial beings known as androids. Aristotle described the wooden Venus, capable of movement, whose limbs were filled with mercury instead of blood.

During the third century, B.C., a flying wooden pigeon was reported.

In the tenth century, A.D., we hear of the creation of an automatic talking head. The great genius Leonardo de Vinci built a moving metal lion for King Louis XII and also created a metal dragon.

Leonard Maelzl, the man who invented the Metronome, created a sensation during his life time with a musical android completed in 1807. He also demonstrated a chess machine which inspired Edgar Allen Poe to write "Maraville's Chessman."



A Man (Forrest J. Ackerman, also known as "4sJ" Ackerman) Among the Robots: Left to right: Automaton Gort (from scientifilm THE DAY THE EARTH STOOD STILL), Robby (from FORBIDDEN PLANET) and Ultima Futura Automaton (from Fritz Lang's scientifilmasterpiece of the 21st Century city of 60 million people — METROPOLIS). Photo by Walter J. Daugherty, courtesy of The Ackerman Science Fiction Archives.

In 1778, Baron Kempleman of Bohemia, publicly demonstrated the first talking robot. The first machine to speak through artificial means. A publication of the day reported that "the monstrous thing spoke with a voice of a three to four year old child, in a distinct, clear and slow voice."

In the French play "The Revolt of the Machines," huge angles, super tractors, gigantic cranes, mechanical saws, dynamic dredgers, even psychological thought-reading devices clash with one another in the hall of a great exhibition. During the night, the machines break through the walls of the auditorium and run wild in the streets — destroying homes, knocking over towers, devastating fields. Military might is mobilized and army artillery is dispatched to destroy the machine monsters. But the guns, and tanks and cannons refuse to fire on their fellow machines, and instead join the rebels. A few human beings escaped and from a mountain side watched the destruction of their man-made world. Finally, the foreman of the machines succeeds in turning them against one another, but in the ensuing civil war they completely destroy each other. But the foreman is already at work on new, even more monstrous machines. And the likelihood is that it will happen all over again.

In his play, "Millenium I," W.A. Dwiggins pictured another possible revolt of the robots. "Millenium I" is a frightening play about Homogrub, sub-terranian man, hiding from murderous machines which possess incredibly powerful means of destruction. At one point of the play, a human being named Blackmaster encounters Point 33 Plus, a robot. And the robot says: "In the beginning was man. Man created all things. Man, with his infinite skill, created machines in his own image." Blackmaster interrupts, "No, no. Not like himself. That was not the idea. Much better than himself. Finer. Stronger. Man made you and we were proud of you but we made you too strong. You broke away from us. We lost control of you. You trampled us into the dust. So now we've come to turn you back into the earth again. Into the salts of metals. Back into the earth out of which we made you."

And now, inevitably, we come to "R U R — Rossums Universal Robots." The famous play that introduced the word 'robot' into the English language. The story, as summarized by Sam Moskowitz, is a tale laid in the near future, on an island whose exact location is not specified. Here the formula that chemically produced artificial humans for use as workers and servants had been adapted to mass production. The manufacturers justified their position on the grounds that eventually robots will free men from all toil and a utopia will emerge. Unfortunately, one of the chemists alters the formula, and the robots who hitherto had been without emotions, assume the desires for freedom and domination that previously had been characteristic only of the human race.

The emotionally advanced leaders among the robots organized a revolt of their ranks, which now number millions in key positions throughout the world. The rule of man is cast off and the human race is ruthlessly exterminated. At play on their little island, the robot manufacturers suspensefully stave off robot attack, but are betrayed by the president of the Humanitarian League, who even burns Rossum's original formula for the creation of robots. Remorselessly, the robots destroy all but one man who makes amend to rediscover Rossum's formula. They offer him the world if he can held them rediscover the secret of the creation of life. However, he is only a builder, not a scientist, and cannot duplicate the method.

In the end, mutant robots named Helena and Pymus become the Adam and Eve of the new android world.

In the films, robots, androids and humanoids came to the screen in "Alita," an early Russian space film of a trip to Mars and a finding of a robot civilization; in "Captain Video," "The Colossus of New York," "The Day the Earth Stood Still,"—with the great Gort, the heroic robot from space—"Devil Girl from Mars," "Forbidden Planet" —with the friendly voice of Martin Milner as Robbie— "Robot Monster," "Target Earth," "Togar the Great," "The Tonkie,"—about a crazy, mixed-up T.V. set from the future that could move about—"Vampires Over London" with Bela Lugosi and many, many others.

Television gave us the notable Alfred Bester play "Murder and the Android."

And now, if you will accompany me on a journey to the future, and a visit to a robot factory. Mr. Wells has kindly lent me his time machine. And Mr. Pal has graciously taught me how to operate it, so that we will not only get to the future, but be sure of getting back. There is one thing you must understand, however, before we take off. We can only go as observers and cannot actually intermingle. If we were to get into the future and get involved, there could be some disastrous results. Suppose, for example, a time traveler went back to 1926 and kidnapped me so that I never saw "Metropolis." Why, then this story might never have existed. So whatever you do, don't leave the electronic field of our time machine. O.K.? Fasten your safety belt.

1970

80

90

2000 — Wow, travelled so fast, here we are in 2050 already.

Say, isn't that a nifty rocket car that robot is assembling? It doesn't look like it needs any type of tires or wheels. Look at that amazing sight over there, suspended in mid-air; great luminescent side — must be supported by an anti-gravitic principle. Let's see, it says right — yes, it's the three laws of robotics propounded by the great Dr. Asimov back in the middle of the 20th century. The red sign reads: "A robot may not injure a human being or through inaction allow a human being to come to harm." The yellow one says: "A robot must obey the orders given it by human beings except where such orders would conflict with the first law." And the white one: "A robot must protect its own existence as long as such protection does not conflict with the first or second law." Very sensible rules.

Robots must — GOOD HEAVENS, the cable snapped. It's holding together by a shred of metal. The man there — the foreman — right below a car dangling over his head! I don't think he sees the danger. The robots, the robot's super sensitive photoeletric cells must have detected the danger. The robot's now leaping at the startled man, who thinks he's gone mad and attacking him. Now he looks up and he sees the danger too late. At the last moment the robot has swept up the foreman in his huge steel arms and tossed him out of the path of the plunging steel object. The dazed man is being helped to his feet by two other robots. He looks at the mass of twisted wreckage, and realizes it is the robot who has saved his life that lies smashed underneath. Smashed beyond repair. The faithful mechanical servant, saved his life at the sacrifice of its own.

Well, that was some experience. Now, just let me adjust this spacial control and we'll move to another observation point.

There's a sign ahead. "Fifty Miles to Rossum City — Population: 2 Million . . . Robots — Speed Limit: 200 Miles Per Hour."

There is a jet car literally flying down the road; seems to be going faster than that that. Oh, oh! Police plane has spotted it. It's zooming down, broadcasting instructions to stop. Well, I'll be! It's a robot at the controls of the car. And the police are robots, too. I see what's happened. The robot driver has a human passenger who's been hurt, and he's rushing him to a hospital. The robot police are now moving the man to their plane, and there they go.

Wow! What a world! Wish I had time to stay here and sight see all over the planet, but the warning bell on my time machine has sounded, letting me know it's time to return to our world and our own time. Hang on.

Well, wasn't that something. That glimpse of the robotic world of the future. You know, something occurred to me while watching those automatons function. They look a lot like men, do much of man's work. I wonder if . . . excuse me a second. Calling electronics department, please. Hi, Frank. Forrest Ackerman. Say, Frank, you're a sound effects man always fooling around with electronic devices. Tell me, do you suppose robots would enjoy listening to music? I'm not joking. You think that if robots are an electronic creation that they enjoy listening to electronic music? So by utilizing the variable frequency audible generator you think you could create a scientific symphony? It would not only send our metal friends, but would also be fascinating to human ears. Would you be willing to work on it? You already have?! I can't wait to hear it.□

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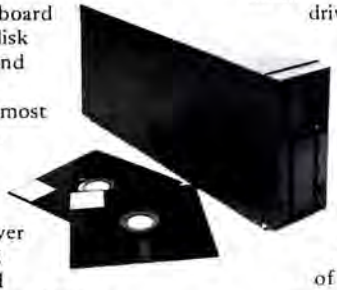

INFO 2000 provides interfacing hardware (Adapter Boards) for all S-100, Digital Group and Heathkit H8 microcomputers. The Adapter Boards provide all necessary interfacing logic, power regulation, and support an EPROM-resident CP/M bootstrap loader. The Heathkit H8 Adapter Board replaces the Heath 8080 CPU board and upgrades the H8 to a Z80.

If you change to a different kind of computer in the future, you can still use your disk drive and controller. You need only purchase the appropriate replacement INFO 2000 Adapter Board.

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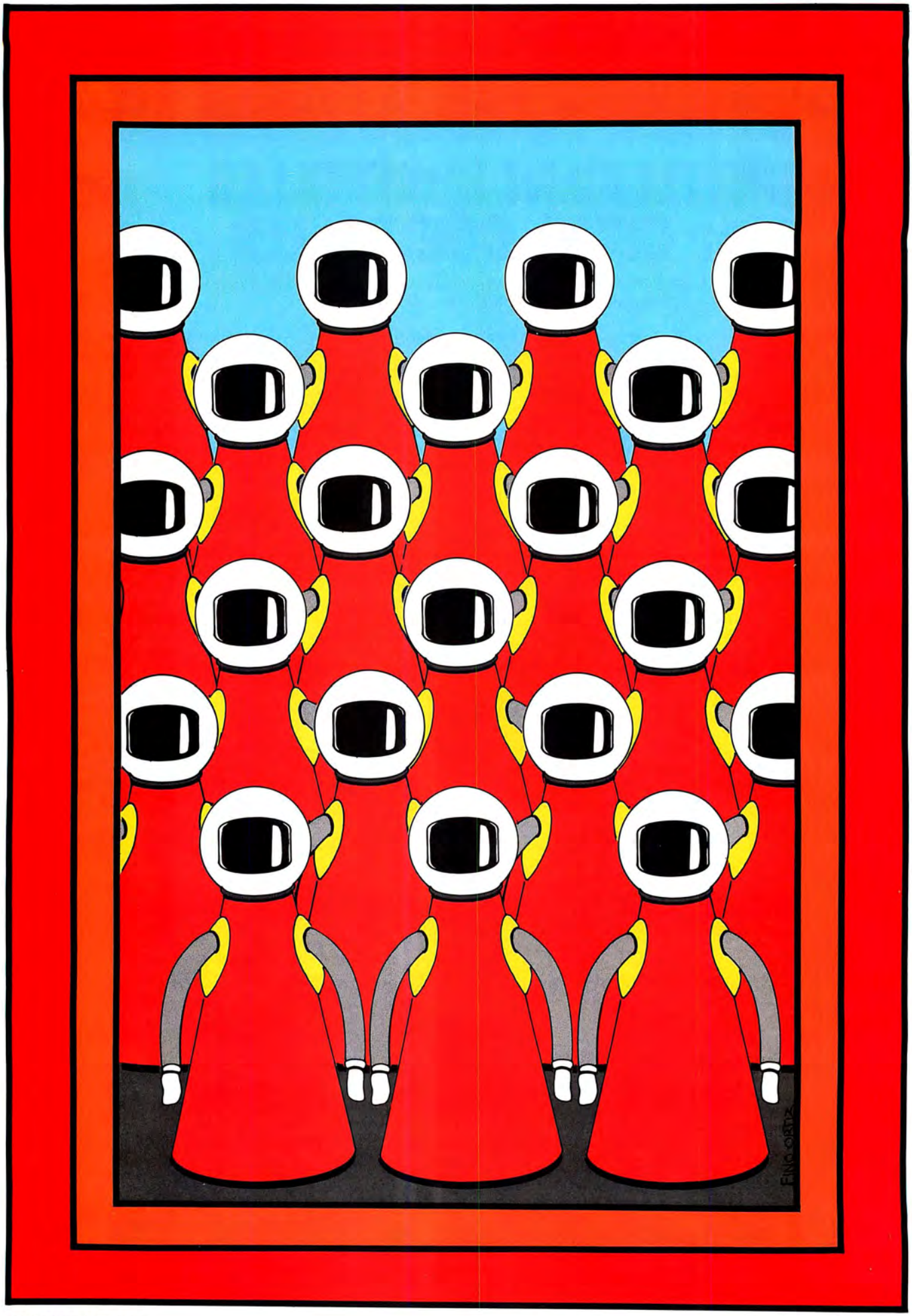


The Quasar Industries' Robot

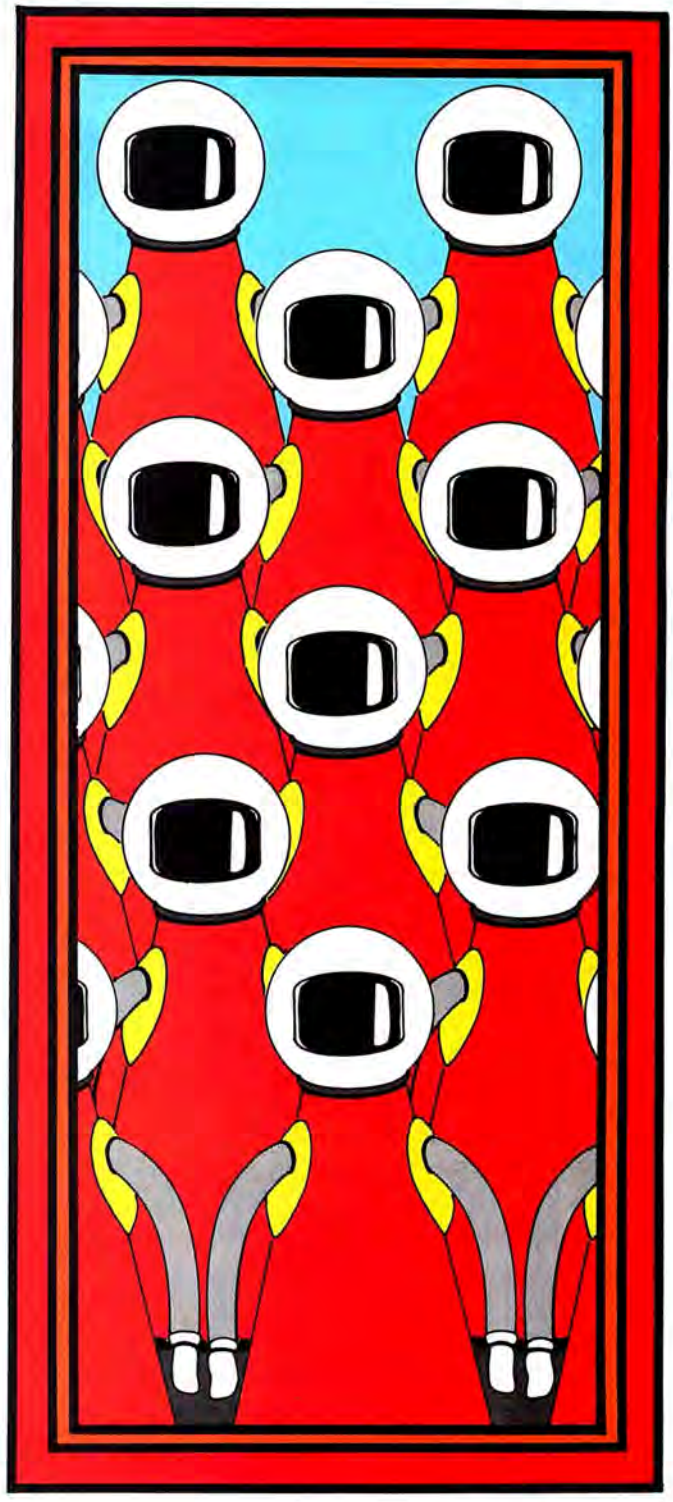
A Dream That Came True

By Gene Beley

Android Amusement Corporation

Robots are going to be part of our everyday lives, and Quasar Industries seems to have a head start on getting us there.

Gene presents the story of Quasar in a light-hearted fashion, and whets the imagination for future developments. —*Editor*



Nine years before *Star Wars* jetted through the movie theaters of the world, introducing two lovable robots, Quasar Industries, Inc. of New Jersey gave birth to a full-size working 'droid, Klatu. Even though Klatu was the result of more than 40 designs submitted by an eight-man team of engineers and scientists, of whom nearly all succumbed to death or serious illnesses before his succesful completion, there was no worldwide media fanfare. In fact, Klatu was quickly put to work to help pay R&D costs. From the very beginning, Quasar Industries began leasing the robot out to corporation and others for an attention-getting marketing tool.

To this day, Klatu and his 31 brother and sister robots lend their 15-square-foot conical-shaped bodies for displaying various graphics and logos of major corporate clients like Panasonic, Ingersoll-Rand, I.T.T., major banks, and others who can afford their star-billing rates. Currently, they are leasing for $700-$1500 a day, plus expenses. These robot stars fly first class on commercial jets when they travel to engagements. Moreover, each robot is accompanied by two robot technicians wherever they travel.

Quasar Industries now has 32 working 'droids, which they call Sales Promotional Androids, or SPA's for short. In addition, Quasar Industries has working prototypes of the Domestic Android, robot-servant, which will be marketed within two years for approximately $4,000; a seven-foot high security-guard robot with a $75,000 price tag; and a Para-Medic Robot that will work in hospitals that can afford the $50,000 tariff.

HOW IT ALL BEGAN

Anthony Reichelt, who has an engineering, design and marketing background, started to make a 30-inch toy robot that would speak about 25 words on cue. He quickly learned, after much research, that would be too expensive to market as a toy. However, he decided there was a market for domestic androids.

"We began with an eight-man team of scientists and engineers who set goals of developing three basic robots: the Domestic Android, Century guard robot, and the Sales Promotional Android," Reichelt said. "Due to the state of technology eight years ago and the economic factors, the Sales Promotional Android received the top priority.

"In 1968 we produced the first SPA series robot. To give you an idea of how far we've come since then, we are now working with our SPA 20 series, which represents many technical advancements."

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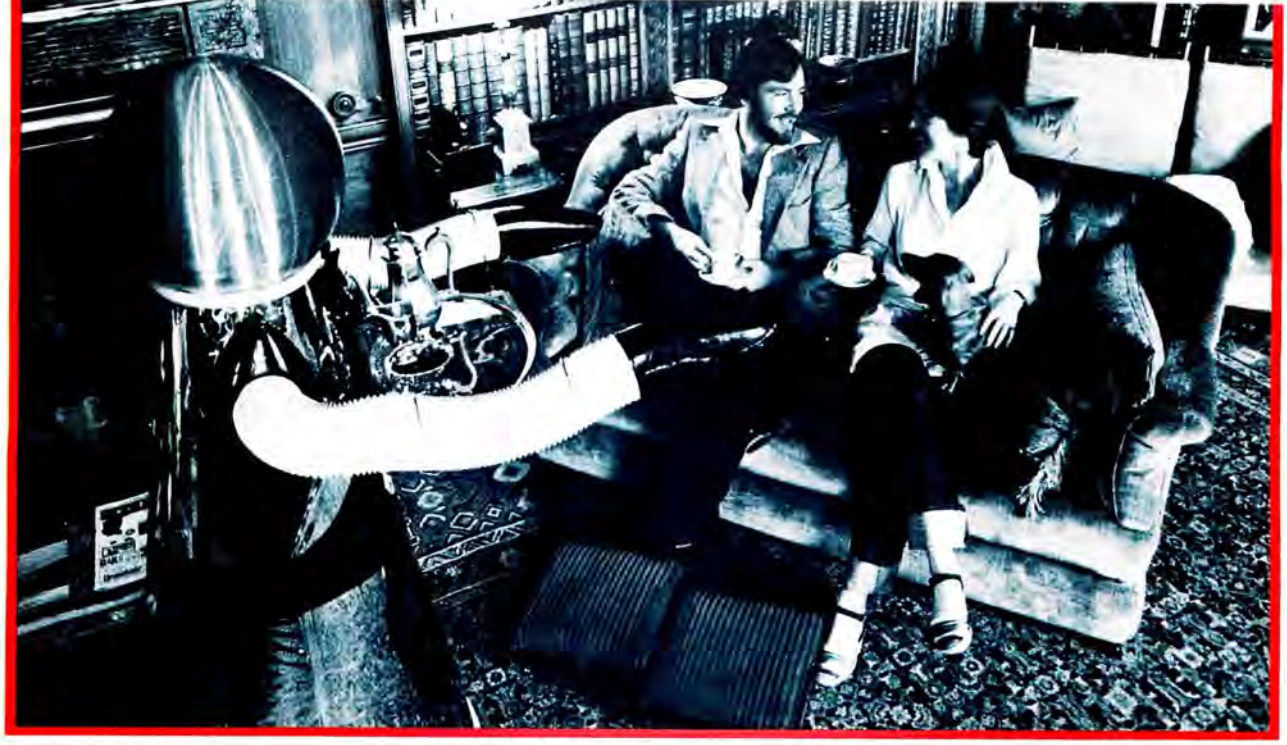


That first eight-man research and design team was made financially possible through the predecessor company and a small stock issue in New Jersey to form Quasar Industries, Inc. "We organized for the specific purpose of making mechanical humanoids," said Reichelt, "and that has continued to be our exclusive business to this very day."

The SPA's are five feet, four inches tall, which the company found was the best height for maximum psychological appeal in promotional events. The SPA's weigh 240 pounds, which make them light enough for almost any method of travel. The conical-shaped bodies provide the proper balance necessary for working salesmen 'droids to operate in a crowd without tipping over.

Quasar Industries' robots do not have any facial features. Reichelt's staff long ago learned, though, that there was a psychological advantage: their robots didn't get type-casted into a set image. They were identified with the sponsor.

Underneath the exterior costumes and "stage" names beats the heart of Klatu's Q-16, special robotic comptuer, designed from scratch and capable of voice recognition and audio responses. Reichelt explains that the SPA rolls on hidden tires underneath its conical-shaped body and can go in any direction at various speeds. Arms, elbows, and hands are fully programmed and can operate independently. Though the SPA can't see in the same sense as humans, its sensors detect shades of light to determine mass. In an uncluttered area, the SPA's can move with great freedom. When the crowd gets too big, it will go to sensory overload, stand still, until it is able to act again. Air-filled rubber rings encircling the conical base of the robots provide sensors to prevent bumping into objects. The SPA has a top speed of about 20 miles an hour.

Quasar Industries started to design a five-digit hand but rejected it because of overall cost and power requirements to build six motors necessary to operate each assembly. The final two-digit system in use today required almost one year of revisions before it was perfected. The steel tube arms with elbow, wrist, and motor drives are covered with flexible tubes (that look like common vacuum cleaner hoses). Original additional movements included rotation of the head and waist, but have been rejected for power, space, and practical requirements.

"No one will ever know the total frustration and discouragement we suffered in our small lab creating Klatu," sighed Relchelt. "Weeks, or even months of exhausting work would be completely wasted with the push of a button or inserting a plug.

"There was no manual or reference book to follow. The team was literally writing the book as they went along."

Thus it becomes more understandable why Reichelt attempts to maintain company secrecy about the innerworkings of his robots. Although he has made some television appearances and gives occasional interviews, he prefers to remain in the background, or out on the road with his robot teams, as "that is where the real R&D is being done today."

The original research team was hampered by constant daily problems of where to find parts, system adaptation and body design. But these were only minor problems. "Fate seemed to strike one blow after another, as if someone, or some unknown force, was trying to block our progress," Reichelt remembers.

"The physicist working in the area of subsystems compatibility suddenly died," he continued. "Before the team could recover from that shock, the professor, with a Doctorate in Engineering, and specialist in inertial guidance systems, went blind."

More medical problems hampered the team. The laser specialist developed a serious kidney disease; the mechanical engineer working on the interrelated mechanical systems retired because of multiple sclerosis. And two more members of the team, the research specialist for parts analysis and the power applications engineer, died before Klatu was completed.

That left only two original team members to see Klatu leave the lab under his own power. Inside he contained the desire, dreams, and dedication of eight human beings. Klatu finally could walk, talk, and perform well enough to be leased out for promotional events. As time progressed, the voice was further developed to include inflections. A lightening-bolt-like streak of light illuminates its head when it talks.

Quasar Industries feels, now that the public has accepted robots, it is time to move into Phase II of their master-plan. The Rutherford, New Jersey robot factory is now gearing down to manufacture the Domestic Android (trademark) within 18-24 months. Reichelt projects they will produce 125 such robots a day that will sell for

approximately $4,000. The Domestic Android will be programmable via a computer control on its right hand to serve dinner, vacuum, baby-sit, answer your front door, or serve drinks. A 250-word vocabulary will be sufficient to impress your friends and insult your enemies.

Of course, this is straight out of the first chapter in Isaac Asimov's book, *I, Robot,* which tells about the robot babysitter. The child's mother grew concerned when she felt the child should have something like a dog that could return love and pressured her husband to get rid of the robot. The child became despondent over the loss of her robot friend, and the story continues about the search for her mechanical babysitter.

Perhaps the answer, according to a poem by Ray Bradbury, would be a robot grandmother, one who could give "equal love" to her grandchildren. Bradbury, the science-fiction author and father of four daughters, wrote "Robot Grandmother" while observing the personal frustrations of parents trying to give equal love.

REACTIONS OF HUMANS TO ROBOTS

In Los Angeles, California, senior citizens visiting a department store where the SPA, Klatu, was modeling jackets for a ski parka company, looked in disbelief at what they were seeing. "What is it?" one dares to ask a sales clerk.

"A robot," the clerk replies, with a wide smile, rather nonchalantly.

"Now I've seen everything," mumbles one of the senior citizens, shuffling away. "Now I can die in peace."

In Scranton, Pennsylvania, at a hospital charity benefit, the SPA was whirring up and down the hallways, in and out of the rooms. The robot was playing and joking with the children. However, upon arriving at a room marked "Do Not Disturb," Robot Master and Quasar Industries' President Anthony Reichelt asked a doctor what was wrong with the child in the room. Reichelt learned the child had been in an auto accident. Although the boy had recovered from a coma and was capable of speaking, he had chosen not to speak, probably because he was still in shock.

"The doctors and staff psychologists hadn't been able to get the boy to speak," Reichelt recalls. "I obtained his permission to allow the robot to go into the room with the boy, alone."

"Why are you feeling so sorry for yourself?" the robot asked the boy. And then they began trading insults, like the robot's threatening to "put tire tracks" on the boy if he didn't begin speaking. Within 30 minutes, the boy was babbling away with the robot.

This rewarding experience led Reichelt to observe the need for a Para-Medic Robot, which he now has built and trademarked. It is designed for doctors to use in psychiatric cases, especially with children, and will be specially padded and easily programmed by the doctors behind a one-way mirror.

The preceeding represent the wide range of emotions humans project upon seeing a real robot for the first time. Reichelt, who understandably prefers to travel with the robots, versus "flying a desk," could probably write a book on the reactions of humans to robots over the past nine years.

On the more fun side of the fence, the London Daily Mail newspaper invited Quasar Industries to bring the Domestic Android prototype to Great Britain. "We had the robot buy his own ticket at the airport," chuckled Reichelt, "and board a British Airways jet to London with myself and the London Daily Mail photographer.

"We were about 2,000 miles out over the Atlantic Ocean and the stewardess was getting ready to serve breakfast. Phil, the photographer, asked me to have the robot serve breakfast. It took several minutes to program the robot, and it began going up and down the aisle, serving grapefruit to passengers that morning."

"And how was your flight, Aunt Maude?" *Britishers* were probably greeting relatives landing at the airport.

"You won't believe it — a robot served breakfast for the stewardess this morning," passengers were heard to reply. Just as the relatives or friends were wondering if they should call a doctor, off walked the robot, with the photographer taking pictures. Few celebrities get the kind of attention a robot commands upon landing at a major airport.

OCCUPATION: ROBOT TECHNICIAN

There are a handful of humans in the United States today who list that occupation on their official Internal Revenue tax returns. Of course, 25 years from today, the number will greatly multiply. In the not-too-distant future, colleges will undoubtedly institute formal degree courses in robotics — a word barely coined now.

The entire technology is already taught in colleges, but no one has put it together in a precise course. It would undoubtedly consist of computer and mechanical technology; physics, geometry, and a wide degree of experimentation, according to Anthony Reichelt. Although he is hesitant to divulge his technicians' names "because the press would interfere with them getting their normal work accomplished" and "competitive reasons in a dog-eat-dog world," he consented to divulge his training system to INTERFACE AGE for this special issue on robotics.

"We've taken people from all walks of life — not just the scientific or technical fields," Reichelt begins. "An example is an oceanography student I met who took a liking to the robot. We hired him part time on his college vacations, and he eventually changed his major to computer technology. He graduated and now works full time for Quasar Industries.

"A beginner starts as a trainee, whom we call a Manufacturer's Helper in the shop. We tend to develop a specialization within each person. Eventually, they reach the level of Assistant Monitor Technician, which is simply an Assistant Technician.

"Next comes Technician, then Command Programmer. The Command Programmer is in charge of one or more shows where the robot is appearing.

"After about 4,000 hours of actual robot performing time, the accompanying Command Programmer is eligible for the ultimate title of Robot Master. He then may have as many as four different Command Programmers under his supervision."

Reichelt himself wears a gold "Robot Master" emblem, made especially for him by a jeweler in Beverly Hills. He is the greatest task-master and perfectionist of them all. When they are traveling on the trade show and promotional event circuit, although they may enjoy attending client parties at night, Reichelt, the Chief Robot Master, can always be seen in the wee hours of the morning, back in the motel room, touching up small scratches on the robot's conical-shaped body with a can of spray-paint and checking out the mechanical functions for the next day's show. Naturally, there is an element of show business to the bookings, scheduling and behind-the-scenes somewhat grueling life on the road. Reichelt, who is fortunate to have wife Eileen as Marketing Director at the New Jersey headquarters, is proud of their record: in nearly 10 years, they have never missed a contracted performance.

This has not been easy. One time, with a show scheduled in Chicago, he told his two robot technicians to leave New Jersey Friday in a van with the show robot. "Although the show wasn't until Monday, I told them to get there, set up and then fool around.

"They called me in Pennsylvania and said they were

snowbound. I asked them the telephone number in the pay phone booth and told them I'd call right back.

"I got out maps on our kitchen table that night and began pinpointing their location. I called them back and told them to double back and take a road south."

"How far South?" asked the technician in the cold, snowy phone booth.

"Until you run out of snow," Reichelt replied in his typical fashion.

Fortunately, the technicians had credit cards and some cash to sustain them. Reichelt ordered them to call him at his home throughout that night, every hour as close to the hour as possible, so he could calculate the speed of their travels and project their progress.

"I called a friend that operates a chartered Lear jet service," continued Reichelt, himself a pilot and aviation enthusiast. "I told him to have the Lear jet at a particular airport, ready to go to Chicago, in case we needed it. As it turned out, my crew was able to circle around the snowstorm by surface roads and made it to Chicago in time for the show."

This type of philosophy and perfectionism has gained Quasar Industries the great respect of clients, from a cross section of smaller companies that use the Sales Promotional Androids to compete for attention with the corporate giants, to the Fortuna 500 type clients themselves, who love the robots.

Although it isn't something Quasar Industries will readily publicize, the life of a robot technician can be quite glamorous on the road. Since the robots get star-billing fees and fly first-class to many destinations, they frequently work for clients who stage elaborate parties at night. Even if the robot doesn't attend, the technicians are almost always invited. Another fringe benefit, not listed on the Internal Revenue tax returns, are those beautiful models most companies hire in trade show booths. You see, robots are very good at getting the pretty young gals turned on with come-ons like, "Okay, Baby, give me a kiss." But it still takes the human touch to satisfy those very human desires. Although it isn't in the basic training course, Klatu has told INTERFACE AGE the younger technicians are very good at taking over where he leaves off.

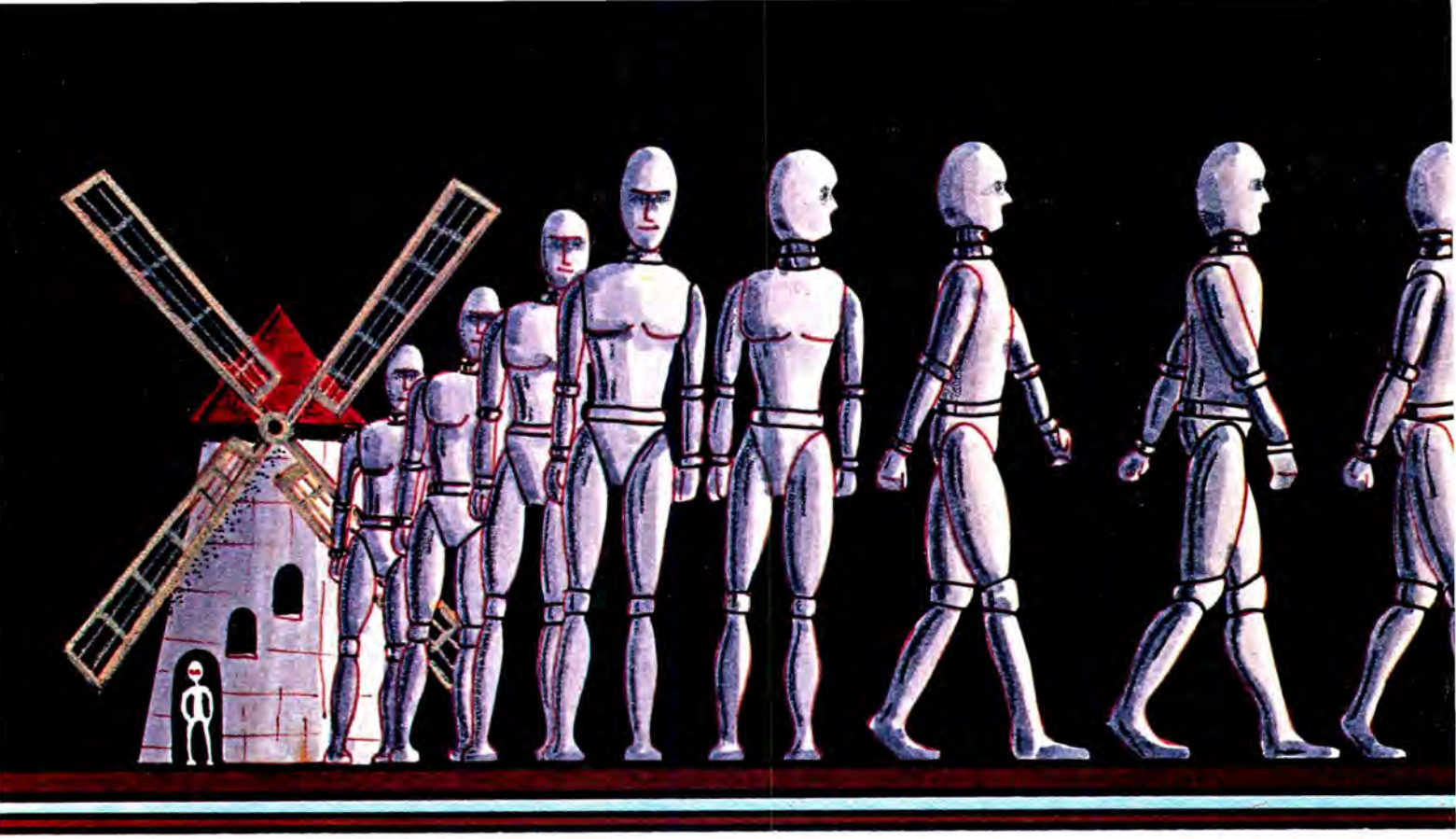
WHAT'S AHEAD FOR QUASAR INDUSTRIES' ROBOTS?

"Bubble-memory, as soon as it becomes practical from a cost standpoint," commented Reichelt. "This technological advancement will greatly increase the capacity of the robot and its ability to do different things."

Century I, a robot designed to function as an automated security guard for banks or military installations, was recently introduced at the annual seminar of the American Society for Industrial Security. At 7 feet, 650 pounds, with a bullet-proof exterior and equipped with all sorts of "restraining systems," Century I means business. Its single purpose will be to find and immobilize intruders. Sensors in the robot can detect movement, body heat, or noise, and then begins stalking the human. Reichelt said its restraining systems are "nonlethal."

So when the day comes that Klatu may gain his deserved super-star status, or his descendants start a robot rock group, they will have their own robot security guards. With Quasar Industries, such science-fiction sounding products exist today and will be in the marketplace sooner than you may think. As for the robot rock group, keep tuned into your local radio and TV stations. And remember, INTERFACE AGE predicted it, in April, 1978. □

Anyone who might be interested in finding out more about the Quasar robots can contact Gene Beley at: Android Amusement Corporation, 2324 Lenta Lane, Arcadia, California 91006, (213) 445-5330. —*Editor*



From Steam Engines to Robots

The defining of just what constitutes a robot has been dimmed by anthropological bias, or the impediment of seeing the robotic scene through Human-Colored glasses. That shambling and amiable tin-man traveler, on the Yellow Brick Road to Oz may be far more acceptable to the viewer than the most complex but immobile logic device. Consequently, there's the rub . . . or byte! When does a computer become a robot brain?

In order to examine these perplexing and contemporary questions, it will be useful to consider and, if possible, categorize the various hierarchies of the robot or cybernetic world. To start with, there is the pre-robotic environment of the servo-mechanism, with its self-balancing feedback loop(s). Even at this primitive level, the feedback loop is itself subject ot varying levels of complexity, interaction, and adaptability. Adaptability is the most essential feature of any organism, animal, vegetable or servo.

Feedback is that quality which immediately separates a large category of objects and systems. The most elaborate-appearing mechanism is nothing in comparison, when put beside a tiny device endowed with the quality of governing its activities in proportion to the varying intensity of its input stimuli, and output responses.

The word Cybernetic, the steersman of classical Greek, comes from the feedback concept. Here is the helmsman, who senses the movement of wind and wave, and adjusts the rudder accordingly to keep the ship upon her course.

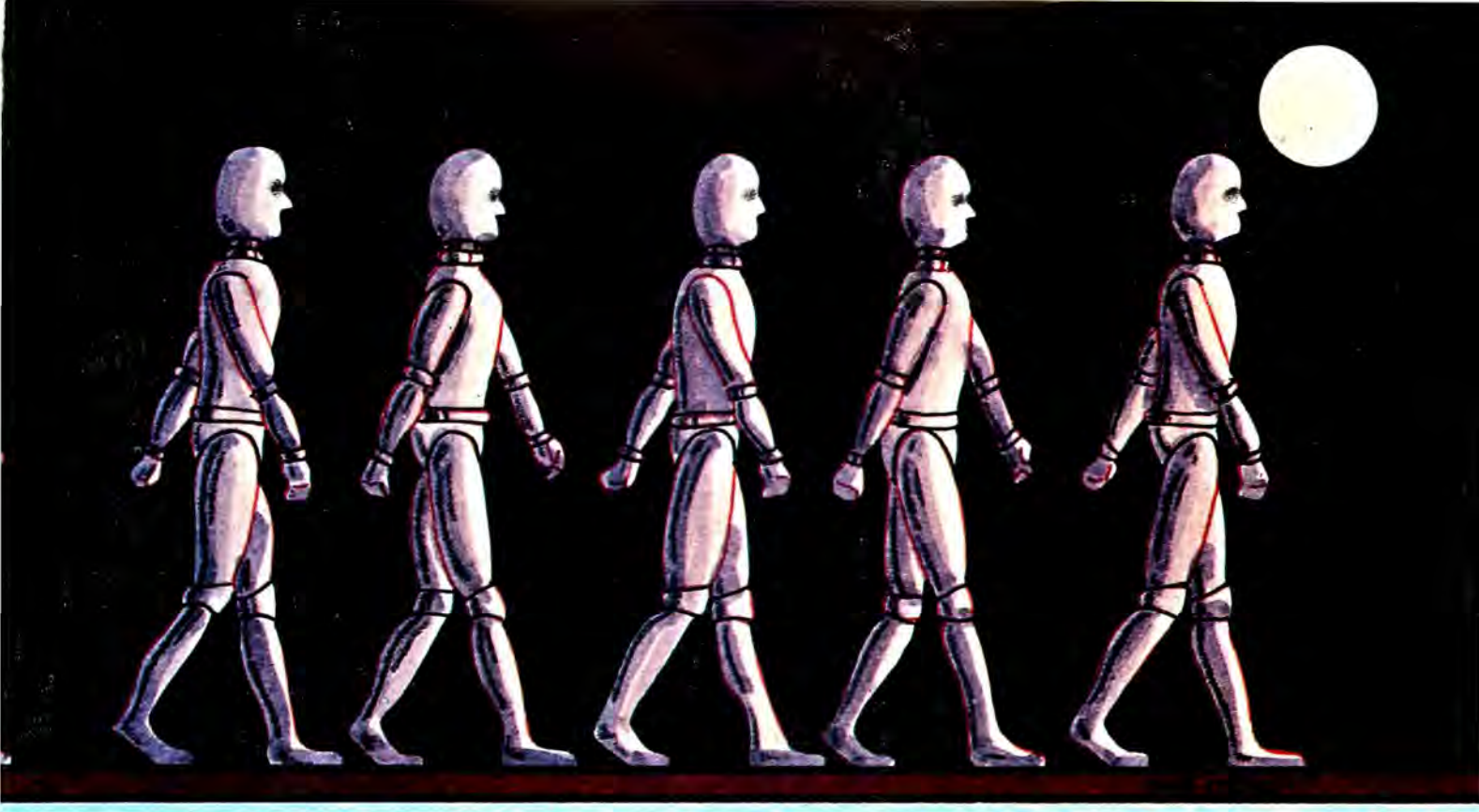
One of the earliest known feedback devices was the Baille-Ble, or mill-hopper, described as far back as 1588. Its use in water or windmills was to distribute the grain to the millstones, according to the rate of speed of the mill's drive shaft. Such feedback factors as grain flow, grain hardness, millstone tension, and drive shaft force, all interacted to determine the amount of grain delivered to the stones.

This was, of course, a very primitive level of feedback, the grain-hopper receiving four jolts for every revolution of the shaft. Man, in the form of the miller, was still required to optimize conditions and design goals by regulating the flow of water to the drive wheel or the wind pressure upon the sails, and to adjust the proximity of the millstones.

Not until the late 18th Century did a more familiar feedback device appear. This was the fly-ball governor, another contribution of James Watt to the perfection steam power. The governor consisted of a pair of iron balls at the ends of hinged arms, and linked to the engine's drive shaft. As the shaft speed increased, the balls rotated ever faster, responding to centrifugal force and causing the linkages to move. This movement was coupled to the steam supply throttle, causing it to cut off the steam with increased speed and to open the valve as the shaft velocity slowed. The fly-ball governor continued in use well into the electrical age and was even employed with early phonograph motors.

The 19th Century saw, too, the growth of hydraulics as a science, and feedback also appeared here in the form of Leon Farcot's Servo-Motor of 1868. Feedback was also discernable in nature, with many writers commenting upon it in terms of the dependency and population oscillations of predator and prey animals, to the conservation of energy in the Solar Phoenix Cycle.

World War II saw research and application of feedback and servomechanisms advance under the pressure of wartime. Bombsights, anti-aircraft gun directors, and radar all fused into integrated systems.



. . . The Hierarchies of Robotic Devices

By F. W. Chesson

These early analog and digital devices converged irrestibly towards today's state of the art, where the external analog world is sensed, converted to, and processed digitally, then reacted upon by analog extensions. Any device which aspires to the name robot is therefore bound to the laws of feedback and stability, if only to maintain an external upright position, or an internal state of data-processing stability. Negative feedback converges and conserves. Positive feedback diverges into randomness and disorder. The first mechanic who managed to assemble a fly-ball governor in reverse discovered this, as the steam engine's speed increased to the literal breaking point. His descendent, at his op-amp breadboard, is no less dismayed as he discovers a hidden glitch of oscillations emerging from his clean-looking Bode Diagram.

Two post-war inventions which captured much popular interest in servo-systems were the Homeostats of W. Ross Ashby, and the "Tortoises" of W. Grey Walter. In the literary area there was Dr. Norbert Wiener's monumental *Cybernetics,* accompanied by, in the science-fiction realm, such classics as Asimov's *I, Robot.*

The Homeostat was, in essence, an interconnected complex (usually four) servo units, so organized that a disturbance to the input of any one unit would reflect throughout all the others, and result in a mutual attempt to restore their state of equilibrium, or homeostasis. This dynamic balance, whose name was coined by Dr. Walter B. Cannon, circa 1930 in his book *The Wisdom of the Body,* expresses the essential requirements for all living creatures, and continuity-seeking mechanisms. Here, simple feedback is transcended by an integrated, responsive, and variable feedback, constantly adopting to external and internal variations.

The other device, or family of devices, came from the investigations of Dr. William Grey Walter, of the Burden Neurological Institute of Bristol, England. Being mobile, the "tortoises" were more visually attractive than the static Homeostats, but perhaps less sophisticated in theory. Basically, they were obstacle-avoiding automata, attracted to light up to a certain level, but repelled by a greater intensity. Later models could home in on a lamp flashing at a certain frequency to recharge their batteries. Their phototropism had been anticipated by "Philidog," the creation of M. Piraux of the Philips organization in France, which was demonstrated at the Paris International Radio Exhibition of 1929. The "dog" would follow the movements of a flashlight, but when the lamp was put too close to his nose, he "became annoyed and started to bark!"

Photopnobia, for high illumination levels, could well have been included in a robot dog built (probably by Westinghouse) for the 1939 New York World's Fair. It was designed to home in on visitors by sensing their body heat and to "bite" their legs. But, just before the exhibit's opening, it was attracted by the headlights of a passing automobile, and charged out an open door like a four-legged kamikaze and was run over, despite the startled driver's efforts to avoid it. If this robot tragedy offers any lesson, it is that prospective designers of automata should consider all possible environmental influences upon their future creations, and then try to program for at least N + 1 contingencies.

The ability to learn from experience, rather than continually react in the same manner, can be considered a prime requisite for any progressive artificial intelligence. A robot turtle which finds, by trial and error, its way through a maze is interesting only from a hardware

standpoint. If its evolutionary successor should record only those turns which did not lead to blind alleys, and thus retrace its path through short order, it may be tentatively applauded.

More sophisticated, however, is the mechanism (or living person!) which purposefully sets out on a different route each trial, to see if there is not an even shorter way through the maze. Finally, there comes the entity which evaluates the design of each previous maze it has run, to predict the configuration of the new one, and therefore how best to optimize each trial run to come. For maze, substitute problem, or task-area, or environment, and we see the evolution of an artificial or real intelligence in its true light.

Proceeding through the robot hierarchy, we come upon a host of diverse and interesting devices, the simulators. If their repetoir is limited and their application highly specialized, they yet have a story of successful problem solving to tell. They present a controlled environment for the student, (human or robot), to enter and manipulate, according to programmed conditions and problems. That early flight simulator, the Link Trainer of World War II, was a pre-flight instructor for thousands of airmen. It provided realistic banks and turns in response to control movements, furnished excellent instrument-flight training, and was virtually crash-proof.

Simulating animal behavior has fascinated Man since Antiquity. Tales of magic horses, brazen warriors, and unbeatable chess-players have caught the attention of writers from the Arabian Nights down through Edgar Allen Poe. The experiments with dogs relating to Classical Conditioning by Dr. Pavlov, earning him the Nobel Price for Medicine and Physiology in 1904, have been simulated over the years, culminating with today's extensive computer programs.

The robot dogs shown in the photograph were developed by the author in the early Sixties, when the teaching-machine "fad" was approaching its heady zenith. At the time of the design, relay logic still had some cost advantages over the contemporary RTL gates, but some transistors were employed for the "eyes" and "ears" of the automated canines.

Pavlov's Classical Conditioning experiments underly much of modern learning theory; hence, if a robot, android, or humanoid is to learn, it is desirable to know what conditioning is all about. On a basic level, Pavlov rang a bell, then fed the dog, measuring the animal's response by the amount of saliva generated. After a while, the bell alone could evoke a salivatory reaction. On a human level, do our mouths not water at the mere aroma of a tasty pie? Or even at the verbal cue that: "Dinner's ready!" . . .? Of course, should the announcement prove false or premature, our *anticipatory response* will diminish markedly. It can, however, be readily restored, along with our faith in human nature.

The electro-mechanical dog was designed to perform the following simulations, which will be examined: conditioning (learning), extinction (forgetting), spontaneous recovery, higher order conditioning, learning curves, memory of stimuli occurrences, and stimuli hierarchy.

In general operation of the simulator, pressing the RESET switch puts the robot dog at an untrained level (electronic brainwash!). Salivation being somewhat difficult to imitate, the response to feeding was represented by having the dog wag its tail, a readily observable act of canine satisfaction. To attract the interest of younger students, the feeding stimulus was simulated via a plastic bone having a concealed magnet. When the magnet end of the bone was in proximity to the dog's "nose," a reed switch was closed, activating a tail-wagging power transistor and solenoid.

Via a microphone and photocell, the dog could "hear" and "see." Normally, the audio stimulus was dominant, activating a Schmitt-trigger delay for a pre-set time interval. If the food stimulus was presented during this period, an AND gate caused this coincidence to be recorded by the Conditioning Counter, a ten-point stepping relay. Today's equivalent would probably be a CMOS type 4017 decimal-decoded counter chip. When a preset number of coincidences, say four, had been registered, a form of relay flip-flop circuitry caused the dog to wag its tail to the sound stimulus as well as to food.

As long as an occasional sound-food coincidence, (reinforcement), occurred, the conditioned state would be maintained. But after another preset number of sound-stimuli without food following, (anticoincidence), say five, the flip-flop resets the dog to an unconditioned state, and it must be retaught.

. . . the Link Trainer of World War II, was a pre-flight instructor for thousands of airmen. It provided realistic banks and turns in response to control movements.

Sometimes, the experimenters found that their animals would recover their condition, (spontaneous recovery), without any apparent external action. This is similar to being given a telephone number in the afternoon, forgetting it totally by night, yet having it suddenly come to mind the next morning, apparently released from some buffer-storage deep in the subconscious. In the simulator, the spontaneous recovery function may be cut in and its "latent period" set by a potentiometer. Should normal conditioning be re-established before it can act, it is reset for future use. Once it has acted, however, it is of a one-shot nature; following a second extinction, true conditioning must follow for the SR circuit to be reset.

After conditioning and extinction, Pavlov found that his dogs not only relearned faster, but that their conditioned response was more resistant to extinction. This learning curve holds true in human education, as anyone who has learned a mathematical equation or foreign language will agree. Learning something the second time around nearly always is quicker and seems to stick longer as well.

The learning curve simulation required multi-level stepping-relays in the original model, whose pick-off points were determined in connection with the original settings for conditioning and extinction counts. Thus, the original number of four coincidences would be reduced to three and then only one, while the anti-coincidences for extinction might be increased from five to six or seven, and then to eight or ten.

When the living dog has been very well trained to salivate to the sound of the bell, it was found that the bell as well as food could be employed to condition him to a new stimulus, such as light. This is higher order conditioning, and represented the simulator's highest accomplishment, being activated by the learning curve counter.

While the above model and its concepts are quite elementary, they nevertheless furnish a base upon which increasingly diverse and subtle forms of learning behavior may be simulated and explored. It has been found, for example, that conditioning is more resistant to extinction when every trial stimulus is not always rewarded. this *variable reinforcement scheduling,* could lend itself readily to microprogramming applications.

Leaving the fascinating domain of the simulators, we ascend to new heights of cybernetic sophistication, in-

habited by mechanisms gifted with wide degrees of freedom. Now the question becomes, what constitutes a robot? Mobility, while attractive, is neither necessary nor sufficient. Humanoid, or even animal, form does seem to hold an almost irresistible appeal.

In the area of humanoid forms, there arises another dilemma of differentiation; robots versus androids. Androids, according to established science fiction traditions, are human appearing automata, either clad in realistic plastic flesh over a mechanical superstructure, or else composed of natural organic compounds. The latter may be laboratory-made flesh and blood, or like Dr. Frankenstein;s unique creation, reassembled from second hand au-natural ingredients. The media generally favor the purely mechanistic robotic form, ranging from the lumbering "Robbie" of the old "Lost in Space" television series, to the engaging Laurel and Hardy-esque of the "Star Wars" movie. The recently terminated TV series "Logan's Run" opted for the android version.

When it comes to what defines a robot, we may consult a table appearing in the book "Thinking by Machine," by the French scientist Pierre de Latil. Here, the various levels of automation are presented, commencing with simple tools and climaxing with a god-like entity, which determines its own matter for creation. Somewhere in the middle are thinking machines contemporary to our present technology or waiting in the wings to make their entrance. Perhaps some do not care to appear, preferring to remain behind the scenes, pulling the strings of human puppets!

SOME ROBOTIC HIERARCHIES

A remote printout or video terminal hardly seems to qualify for any level of robot society, yet, put it on wheels, (or legs), and program it to make the rounds of an office full of human operatives, and its status is considerably elevated. It is almost entirely directed by some remote intelligence, having little more initiative than to signal back that it has encountered an unprogrammed obstacle in its accustomed path, or that human operative Number 6SJ7 is requiring excessive copies of print-out forms, which may just be ending up as paper airplanes.

From this motorized mail clerk, it is a few steps upwards to the servo-secretary. Our tin person may be of limited aptitude, but whether clad in pink plastic or bright brass-work, it ambulates on two good legs, though auxiliary training wheels may be necessary for those pesky stairways. Avoidance of persons and other randomly appearing obstacles is possible through built in subroutines, but all sensory inputs are monitored by the remote brain which takes over at the slightest deviation. Our servo-serf may even be subserviant to a robot foreman, who may have the responsibility for an entire office floor or production line subsection.

Our supervisor robot could exhibit an increased status by competently handling a variety of problems in the daily routine so that the most efficient use may be made of the *workers.* He may communicate with both his master CPU and authorized humans, to accommodate schedule changes and cope with emergencies. At all times, however, the servo-supervisor should remain properly defferential towards the lowliest *office person.*

If socially interacting robots are going to encounter the public at large, they will have to obey, in general, the Three Laws of Robotics, as set forth by Dr. Isaac Asimov:

1. *A robot may not injure a human being, or through inaction, allow a human being to come to harm.*
2. *A rbot must obey the commands given by human beings, except where such orders would conflict with the First Law.*
3. *A robot must protect its own existence, so long as this does not conflict with the First or Second Law.*

Within these rigid appearing laws, there may have to be room for various subsections and clauses, tailored to meet evolutionary robot technology. For instance, under what circumstances must a robot obey an android? Does the outward appearance of human flesh take precedence over computing ability? Will some robots obey other robots rather than men, and hold silicon oil more sacred than red blood? Truly, like all Holy Writ, the Three Laws will be subject to human and robotic interpretation.

Our supervisor robot could exhibit an increased status by competently handling a variety of problems in the daily routine so that the most efficient use may be made of the *workers.*

As indicated above, the social robot will be subject to vastly greater memory and decision-making needs. His state of *liberation* from a restricted operating environment will depend not only on his command status with other entities, but by his capacity to cope with short and long-term goals and their modifications. All, of course, in addition to general *housekeeping* requirements, such as balance, walking, (or other forms of locomotion, not excluding water propulsion and flying), obstacle avoidance, sensor input monitoring of potential dangers, internal monitoring of CPU and memory functions and redundant circuits, and naturally the sense to come *home* for a battery charge or atomic pile replacement.

The more integrated the robot, the less it must obey the commands of the external world. If it is linked at all to other robots or a *master brain,* it is only for consultation of common goals or problems. Data shared and compared, it announces to a waiting human that everyone in the 9002-Class had better be retro-fitted with 25-GHz data-links in no less than 103.75 hours, or there will be a cybernetic job action that will make the Great Servo-Strike of '98 look like a party by comparison.

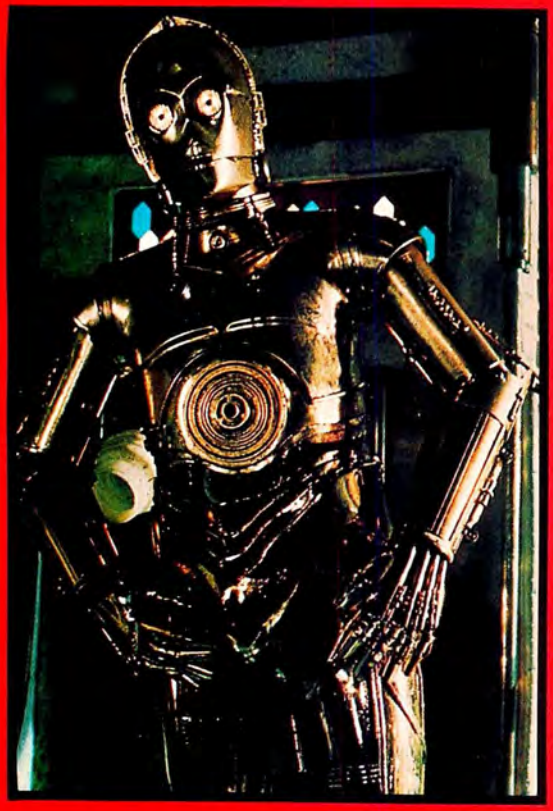
While the very free robot may contemplate the status obtained in commanding a whole army of subordinates who execute such routine duties as interfacing with mere humans, and other feedback-flunkies, the Hardware Hobgoblin slips into his DO-Loop reveries. State-of-the-art memory has failed, in the face of sheer volume, to meet the exponential rise of bit requirements. The *robot master* must give up his cherished mobility, delegating sensory input and decision output to a host of lessor but ambulatory surrogates, which we have passed on the way up.

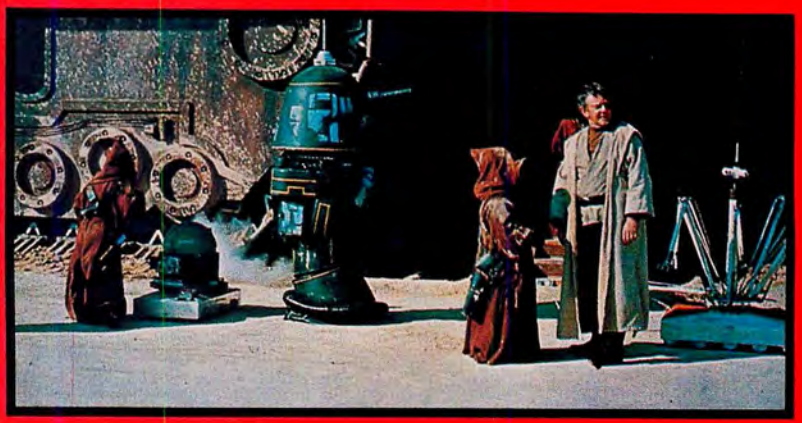
Near the top of the hierarchy pyramid, there is room for but a few of the elite. These converse, when necessary, in twittering tera-hertz, of things beyond the ken of long vanished mortal minds, having taken creation from the hands of their creators.

What is the future for the lonely lords? May they destroy their human designers in war games suddenly turned real? Will they compete via servo-soldiers for the vanishing material and energy resources of the depopulated and plundered planet? Or will our robots survive us, to spread a vanished mankind's eternal message of Hope throughout the galaxy, perhaps appearing in android skins before the wondering eyes of simple shepherds on a Distant Star?□

STAR WARS

Special Production and Mechanical Effects





By John Stears
Special Production and Mechanical Effects Supervisor "Star Wars"

Although the robots that appeared in "Star Wars" were not true robots, they did stir a great deal of interest. Consequently, we asked the genius behind them, John Stears, to give us an idea of what went into their design.

We would like to thank the Star Wars Corporation, and Twentieth Century-Fox Corporation, for giving us permission to use this story. —*Editor*

DEVELOPMENT AND DESIGN OF ALL ARTOO-DETOO ROBOTS

(In conjunction with the production designer, who was responsible for their general appearance.)

The problems were many, inasmuch that the director wanted to use a human as much as he could so as not to loose the character to a pure mechanical machine. This posed the question of how small a human, sufficiently coordinated and physically able, could be found. I obviously had to design my robot around the person selected, bearing in mind the limitations of what the operator inside could possibly do without undue strain, as he was to be inside for long periods in the discomfort of the desert sun and the studio lighting.

After selecting our midget (Kenny Baker), the first problem was to make him as comfortable as possible, yet make his shell as small as we could. This was accomplished by a harness over his shoulders attached to a seat. This took the weight off him until we were ready to turn the camera, the robot being supported externally until the last second. One of the big problems, as you can see, was weight, and how to keep it as low as possible.

The next major problem was how to get him to walk. The various types of surfaces he had to walk on were to range from soft sand, salt often saturated, uneven stones and shiny slippery studio sets. One added disadvantage was that often it was not to be a level surface.

This was achieved by various types of surface on his boots, which ranged from a series of non-return rollers to give a forward movement, to others which had a number of spring loaded balls on each side of the boot, which enabled him to sway from side to side.

A very important factor was vision for the man inside to enable him to walk to his marks and most important to keep his balance. This was done by a one-way lens in the detachable head, which was on roller bearings to allow it to be turned 360 degrees by the operator (Kenny), although he could turn his head from side to side.

The actual majority of weight which was displaced when he walked, i.e., the side to side action, was assisted by spring loaded pistons placed externally on the legs.

The external arms which had to function were counterbalanced in order to let the operator lift and perform the various tasks required. The amount of room he had to move his fingers, which were of short stumpy type associated with dwarf genetics, was possibly no more than 1".

In order to give Artoo-Detoo a visible change in mood, I used fibre optics, which in turn illuminated a panel in the head. Using colors to give the effect of a change in mood was accomplished by using a single light source with a motorized color wheel.

Other light sources were installed for the hologram projector, all of which were powered by high-output, jelly-type non-spill batteries.

There was nothing used in the manufacture of both Artoo's which was not machined, with the exception of the viewing lens. I was totally responsible for their creation, apart of course, from their conception, which was George Lucas's; and their cosmetics which, as I said, was done in conjunction with the art director.

A mechanical version was necessary because in order to move quickly a third leg had to be dropped in the center in action, which allowed it to be steerable. Infinite speed up to 7 mph was achieved through twin high torque motors mounted in the feet of the outside legs. The steering was by a two wheel mechanism in the front leg, the name of which does not exist and made no sense to anyone until it was installed and worked.

Mechanical Artoo was controlled by using a conventional radio transmitter and receiver as is used for flying models and boats. The servos in turn were hooked up to various relays and speed controllers for the operations required. The main power was supplied by a series of 6 volt jelly batteries.

Although everything checked out beautifully on the one and only test it had in the studio, we had a bad time for a few hours in the desert. A sand storm, which created very bad static, affected our transmitter range. This resulted in Artoo-Detoo and Threepio appearing to copulate in front of the unit in the middle of the desert. Up until now it appears to have been futile, but one can't be too sure of the gestation period of robots.

Apart from this incident, and a bit of damage to the dropping leg caused in transit, all the robots functioned well.

TREAD ROBOTS

There were four of these, which are incidental to the two principal robots, Artoo-Detoo and See-Threepio.

The Baby Box is the odd one out here because it functioned in the Death Star only. It is the little black box which careens around doing its thing, which includes a little cameo of mine in the reaction it gives when it sees the Wookie. It screeches to a halt and does an immediate about-turn and shoots off at an alarming rate in the opposite direction. There were several of these Baby Box Robots, some of which pulled many trucks behind them.

The Dome Robot as seen with the others by The Sand Crawler is really, in my view, the power source for the others to re-charge themselves by. Inside the smoked perspex dome is a rotating solar panel by means of which it collects solar energy and stores it for the other robots to plug in and recharge their own batteries.

The Stick Robot, which assists Luke at the vaporizing units, had a pneumatically operated arm. Unfortunately it is not featured in the final cut.

The Umbrella Robot has electrically powered features and a pneumatic scoop for collecting soil samples.

All of these robots were radio controlled. The main problem was the terrain they were to be operated in: hard compressed sand, loose sand, dry salt, wet salt and small rocky areas. They had to be very powerful and weighed in at around 250 pounds each. They had to be capable of handling steep grades and turn in their own length. The biggest problem I had was to make a self-cleaning tank track; one which would not push itself or the wheels through a build up of sand, etc., but would stay put no matter what. On close inspection you will see how I did this. Radio controlled model aircraft is one of my hobbies, which enabled me to operate the robots with any sort of precision. I had a few problems when my crew members had to operate them, because of more than one robot in a shot. They did very well, though.

SEE-THREEPIO

See-Threepio, being a humanoid, I was not involved with, apart from helping out with articulation problems and his illuminated eyes. These I accomplished with one way lenses, incorporating the light source.

I was responsible entirely for his oil bath.□

A Natural Approach to Artificial Intelligence

By Roger C. Garrett
Northeastern Regional Editor

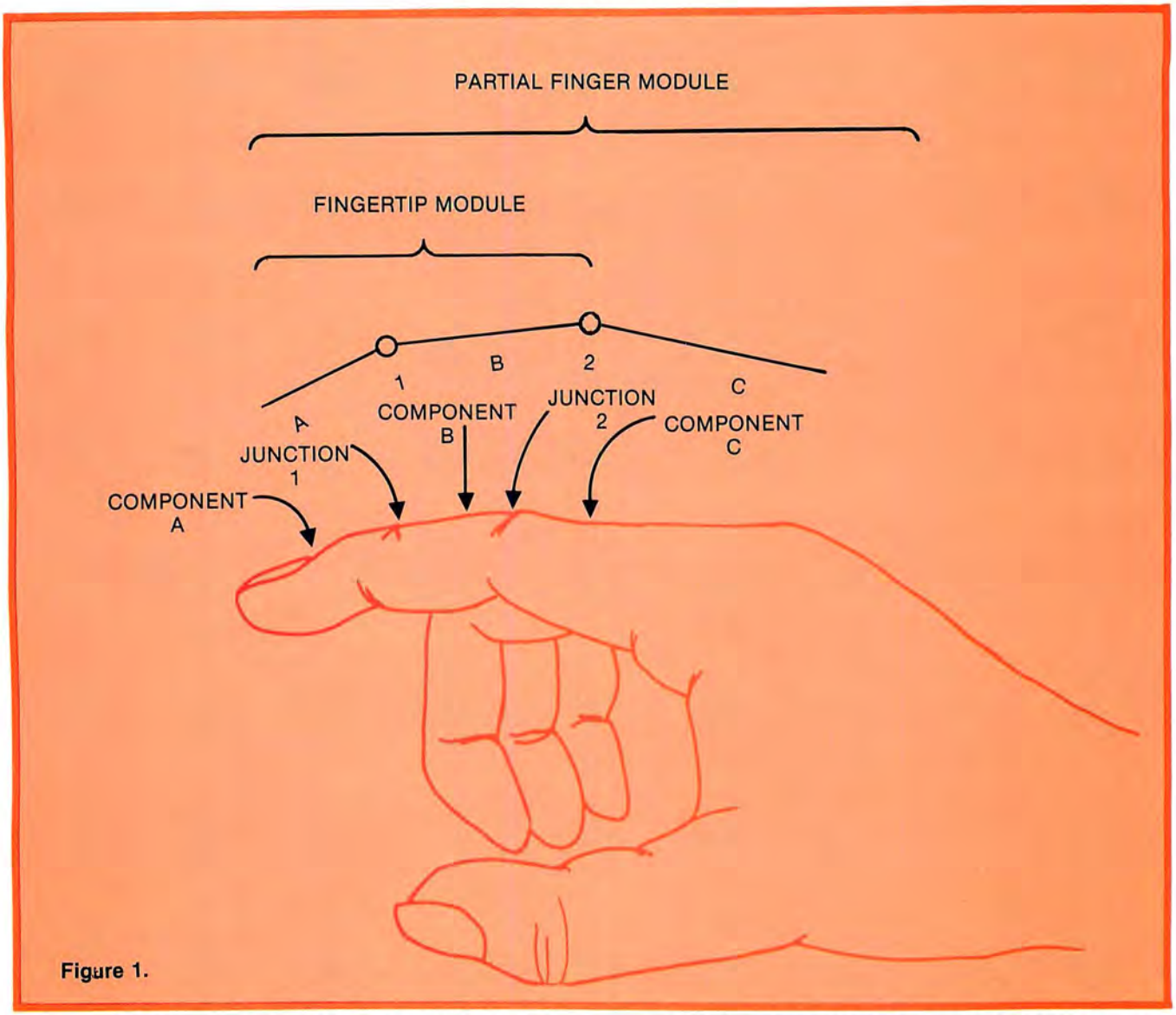


Figure 1.

Every robot that ever has been or ever will be built is made up of two basic components. The most obvious is, of course, its hardware. Just as your first impressions of another person on your first meeting are established based on his or her physical features, so our initial concepts of a robot are generally based on its appearance. The mechanics of a robot, however, comprise the simplest part. It is well within the technology of mechanical engineering to produce a relatively impressive assemblage of gears, levers and joints. So, while the physical appearance of the robot undoubtedly forms our first 'opinion' of its sophistication, we must look deeper to determine the true intelligence and practicality of the robot; just as we must look deeper into the personality of our human companions to know their true self.

It is this second basic component, then, that I will discuss here; the *intelligence,* that ill-defined combination of memory, algorithms, and I/O that turns the controllable hardware into a robot.

It has occurred to me that the approach taken by many researchers in providing machinery with intelligence is possibly not the most fruitful. Often a particular task is identified which could, in the opinion of some corporate management, best be handled by a dedicated robot. A prime example of this is the computer-controlled mechanical arms that perform certain spot-welding operations on the Ford Pinto automobile. The development cycle goes something like this: a task is defined, hardware is designed and built to handle the specifications, the required fields of computer technology (such as pattern recogniton, real-time processing, and artificial intelligence) are called upon to develop the algorithms for accomplishing the given task, the hardware and software are put together, test are run, and finally, the "robot" is placed into the production line.

In general, what this results in is a dedicated system. That is, it solves the given problem, but it is not flexible. It is difficult to adapt to different situations other than

those which fall into a relatively small classification. The spot-welding robot arm might be adapted to spot weld Mustangs as opposed to Pintos, but there is little chance that it can assemble windshield wipers or screw caps on toothpaste tubes.

It is this inflexibility that stands in the way of real progress in robot research. And I believe it is a direct consequence of the approach taken to artificial intelligence. Rather than handling specific tasks and developing algorithms and hardware for each job goal, I suggest that a different course of research be taken.

Consider two things about the human intelligence system. First of all it is a composite of all lower forms of intelligence systems. That is, as the brain developed through millions of years of evolution, it grew in a building-block fashion. Each higher level brain was a composite of the previous levels plus the new extension. It was more than a simple growing in size. The human brain is not simply a *big* insect brain; it is rather an insect brain, *plus* a bird's brain *plus* a squirrel's brain *plus* a monkey's brain, and so on up the evolutionary scale to humans. Our brains include the essence of every lower animal's brain.

Secondly, the human brain is organized as a distributed processing system. Granted, the overwhelming majority of our intellect, or mind, is centered in the brain. Yet all along the spinal column and, indeed, throughout our bodies, are smaller localized processing centers that can perform relatively simple functions which can communicate with lower level, or less functional, processing centers, and with the higher more intelligent centers up to the brain.

Now utilizing these two principles, that of evolutionary building-block development and distributed intelligence, I will attempt to describe what I like to call a natural approach to artificial intelligence for robots.

Consider for the moment the index finger on your right hand and, in particular, the bone that forms the tip of the finger, the joint, and the bone behind it. Suppose that you were to develop a description of the *universe* comprised simply of these two bones and their junction. While this may sound like a trivial, even useless, task, remember that we are developing a systematic approach to intelligence and that we are doing so in a simplest-to-most-complex building-block manner.

First let us establish some terminology so that we

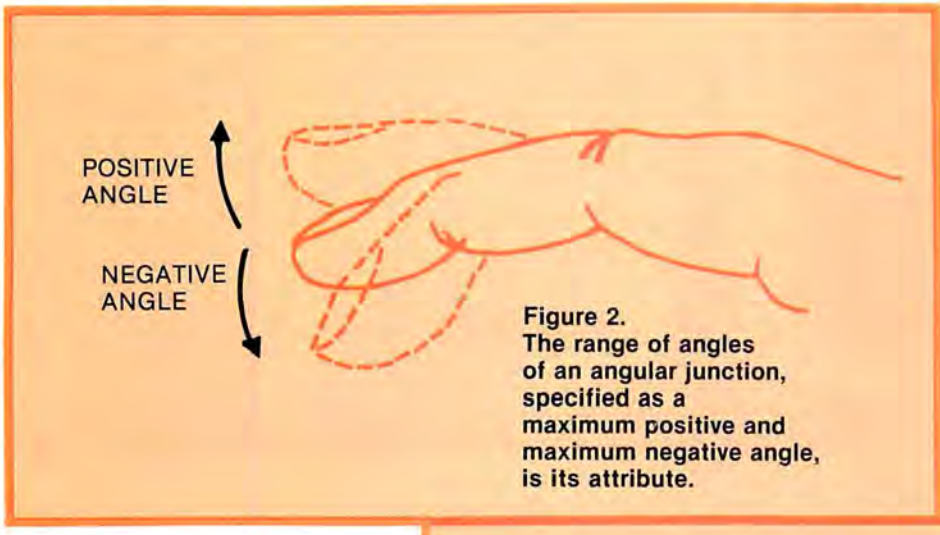


Figure 2.
The range of angles of an angular junction, specified as a maximum positive and maximum negative angle, is its attribute.

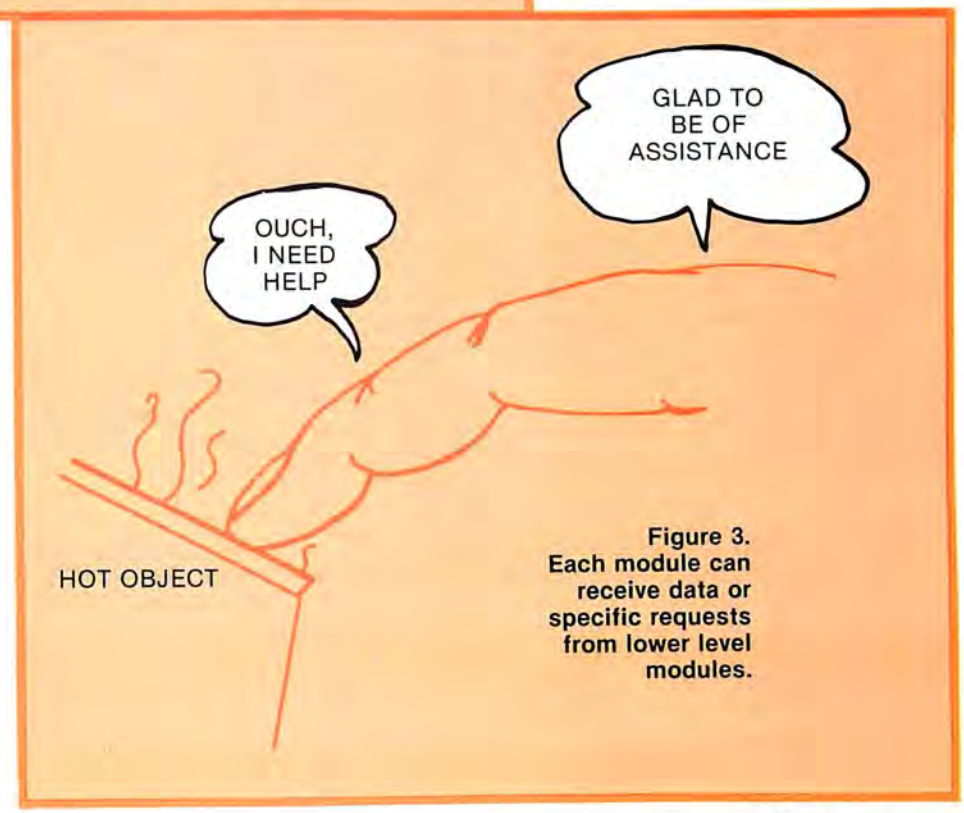


Figure 3.
Each module can receive data or specific requests from lower level modules.

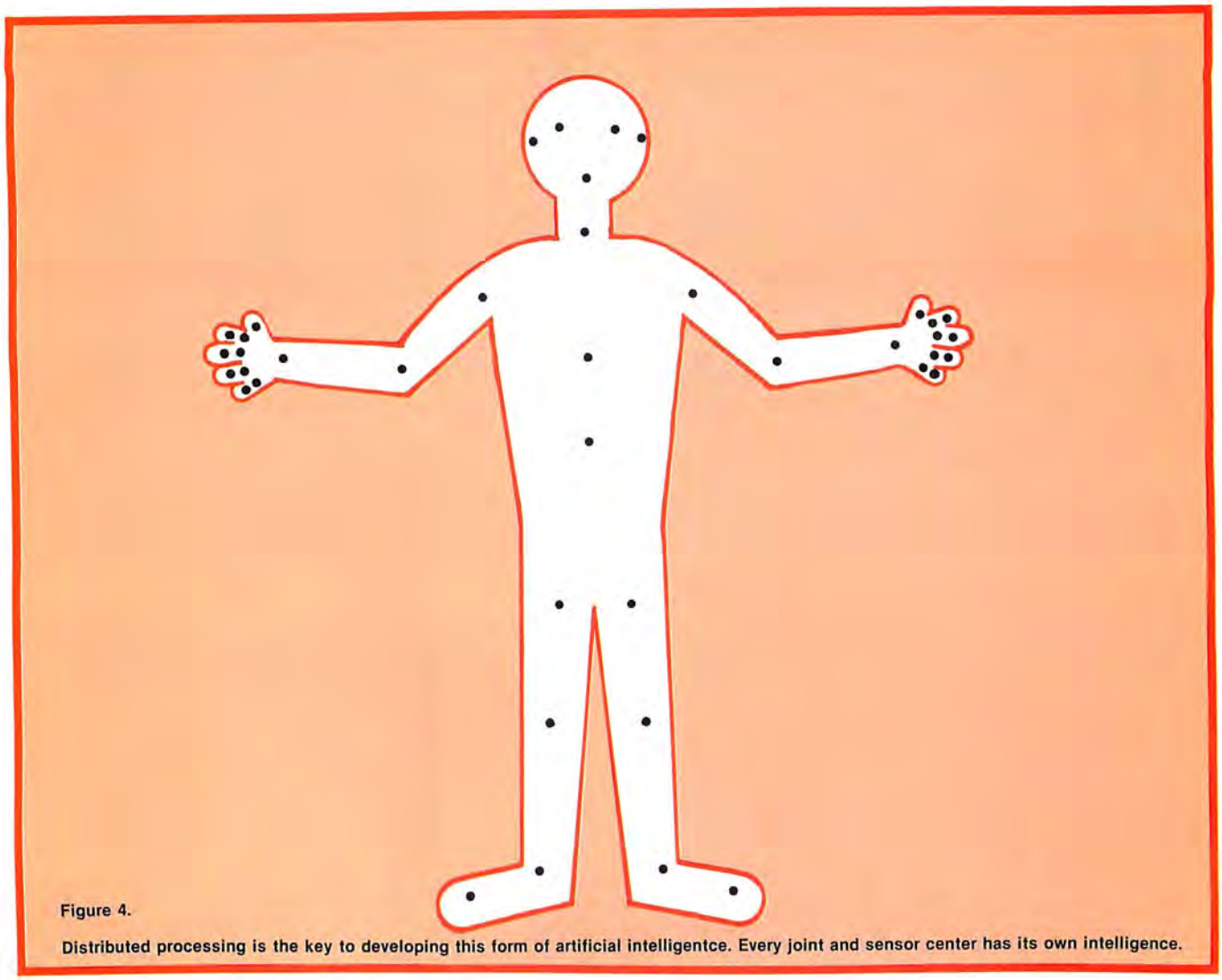


Figure 4.

Distributed processing is the key to developing this form of artificial intelligentce. Every joint and sensor center has its own intelligence.

can best understand each other. Each bone in the fingertip is a *component*. We can sufficiently describe any component by specifying its *attributes* of size, shape, and density distribution. To simplify matters, we might assume that each bone is a cylindrical rod of a uniformly dense material and uniform radius, and of a given length. This might be true in the case of our building a robot. In this way we can describe each component by specifying its length and mass.

The finger joint forms a *junctions* between two components. In this simplified case, the junction is a simple hinge-like joint which we shall call an *angular junction;* that is, it allows the two components to form an angle in a single plane. Other forms of junctions might include *rotary junctions* such as your wrist* which allows you to turn your hand, and *expansion junctions* such as an hydraulic piston. The angular and rotary junctions should be sufficient to produce a human-modeled robot.

*From a strictly skeletal standpoint, the wrist is comprised of a set of sliding joints and a complicated set of opposing muscles. From the standpoint of implementing it in a robot it can most easily be implemented as a rotary joint.

Just as the components must be accurately described to complete this model of a local universe, so we must fully specify the attributes of the junction. Angles may be established between the two bone components. To make the description of these angles easiest we choose one of the components as a *reference.* In the fingertip model it will make most sense to establish the second component, that is, the bone which is not the finger*tip* to be the reference, since we seldom move the second bone relative to the first one. For simplicity let's call the tip bone component A and the other bone component B. It is component B which we are specifying as the reference.

To define the junction attributes, we establish an axis centered through the reference and specify that component A can make any angle with reference B between a particular positive angle and a particular negative angle. The junction attribute, then, is a range of angles. If you look again at the fingertip of your right index finger, you will see that its range is approximately + 10 degrees to – 45 degrees.

To complete this intelligent fingertip we now add a brain, a control mechanism, and sensors. The brain might be biological (ganglia) or artificial, such as hard-wired logic or a central processor unit and software. It might also consist of a set of subroutines resident in a large computer system. The control mechanism will be some device such as a geared stepper motor or a controllable hydraulic system which moves component A relative to component B, (the reference). Biologically, this control system corresponds to a muscle. The brain, then, can control the angle between A and B, or, put more simply, it can wiggle the fingertip.

The sensor inputs to the brain will include at a minimum the current angle between A and B. It might also include heat, pressure, and other sensors located on the components, a movement-resistance sensor on the control mechanism (muscle), and so on. Obviously the more sensor inputs to the fingertip brain, the more intelligent it will be.

So, we have described the universe (environment, realm, world-view) of a fingertip. What functionally can it accomplish? Consider yourself as being the brain of the fingertip. Your only understanding of the universe is the attributes of your environment (those of the two components and the junction), the inputs from your sensors, and your ability to exercise a certain amount of control over component A. That is all you know of your realm. You cannot see what is "out there" beyond your realm, although you may be able to *sense* things within the range of movement of component A. Once you stop sensing something, however, you probably cannot assume that it remains in the same position relative to your reference. Indeed, you don't even know where your reference exists relative to anything outside of your very local realm of existence.

Your intelligence might be limited to simple reactions to the sensor inputs. If, for example, you detect a dangerously hot object against the bottom side of component A, you might activate the control mechanism to move away from the heat source. Your intelligence would probably be limited to such cause-effect reactions.

Certainly this is a very simple form of intelligence but remember that we are developing a building-block evolutionary form of artificial intelligence. This two-component single junction unit would form one of the lowest levels in our scheme. We will call it a *module,* a very low level module. Let's now go to a slightly higher level, and we can begin to see how we might be able to evolve this into an intelligent being.

Back to your finger; but this time we will include the junction and bone behind component B. For consistency we will call this new junction *junction 2* and the additional component, component C. Finally, for this higher level of intelligence module, our reference shall be component C. The brain of this module, this *Partial Finger Module,* will have direct control over the muscles (control mechanisms) defining the angle between the reference and component B, plus it will receive sensor inputs from component B and junction 2. In addition, the brain of reference 2 will have control over junction 1 and get sensor inputs from component A. This is very important to our developmental scheme.

1. *Every brain (intelligence module) has control of all components and junctions within every intelligence module below its own intelligence level.*

The advantage of such an organization is that if a lower level brain loses control, through injury, power loss, or whatever, a higher level brain can take over its functions. This has a direct equivalence in the human brain in which, for example, the functions performed by a local ganglia can be learned and performed by a higher level within the brain.

We can assume, however, that the brain of the partial finger reference normally does not want to be bothered with direct control of the lower level junction 1. After all, its most immediate concern is with the closest, junction 2. So instead of exercising direct control whenever it wants the fingertip module to do something, it sends a message to the brain of the fingertip module, and tells *it* to perform the function.

Also, since the partial finger module brain considers the sensor inputs from its own reference (component C), component B, and junction 2 to be of most importance, it would normally not be bothered with reading the sensor inputs associated more closely with the fingertip module. So we have the fingertip module send messages to the partial finger module, advising the higher level brain of its own level sensor inputs only under certain circumstances.

For example, both modules might be performing some mundane local tasks such as random wiggling, when the fingertip module realizes that something dangerously hot is touching the underside of component A, but that the component is already positioned at its maximum positive angle relative to component B. In other words, it can't get away from the heat. At least not by itself. So it calls upon a higher level module to help it out of its dangerous situation. It sends a distress message to the partial finger module. The partial finger module then tries, if properly programmed, to assist the lower level module be appropriately moving component B relative to C. If the partial finger module cannot improve the situation, it might send a message to the full finger module and so on up to the highest level.

What we have just done is add two important features to each intelligence module:

2. *Every intelligence module can send "function commands" to all lower level intelligence modules.*
3. *Every intelligence module can send "messages" (normally data or request help type messages) to all higher level intelligence modules.*

I hope you have kept with me so far. I have taken the time to completely define two of the simplest levels of intelligence in order to introduce the terminology and, hopefully, give you some understanding of this approach to artificial intelligence. You should be able now to move upwards on the levels of intelligence necessary to produce a research-level human-like robot. The hand intelligence module might be able to receive commands (perform functions) of *make fist, spread fingers, snap fingers,* and so on; the arm intelligence module, which would include the fingers, hand, wrist, lower and upper arm, and shoulder modules, might accept commands of *reach out to the right, transfer the object in your hand to coordinates x, y, z,* and so on.

There is another type of intelligence module which I would like to discuss. So far we have considered only those with direct control over some form of motion-producing equipment. What about those which do not control motion but rather process only data inputs or outputs? Such modules will include those most directly, and on the lowest levels of, vision hearing, speaking, and so forth. We can consider these as being *pure sensor modules* as opposed to the *mechanical control modules* previously discussed.

A low level voice output module might, for example, accept commands and control the production of the basic phonetics. A slightly higher level would accept alphanumeric representations of words, along with inflection and tonal information, and output to the phonetic module the appropriate phonetics to pronounce the word. The next higher level might process entire sentences.

It should be obvious that the higher we go on the intelligence level, the more difficult it will be for us as programmers to account for every possible functional capability of the modules. The fingertip module was fairly easy, the *right side of the body module* will prove to be considerably more complex. At least two approaches can be taken. The first is to fully define every possible algorithm necessary to handle every possible situation for every possible intelligence module. Given enough time, say from now till eternity, we might just be able to do that.

The other approach is to add functional capabilities to our robot as we develop them and to implement software learning structures into the intelligence modules utilizing, perhaps, reward-and-punishment oriented techniques. It is this approach, that of designing robots in a modularized, increasing levels of distributed intelligence manner, which I believe will provide the most systematic, and hence rewarding, understanding of the nature of intelligence.□

BUSINESS EDITORIAL

By Editorial Staff

Not too many years ago, the integrated circuit techniques that are taken for granted today were being researched in several laboratories around the country. Within a short span of time that research was responsible for a technological renaissance in the field of microcomputers.

As a result of this renaissance, the average man is able to take advantage of the power of the computer, and apply it to everyday tasks. More importantly, this has caused industry to take another look at the possibilities of Large Scale Integration, particularly in the field of small business computers.

With the growing prominence of the microcomputer, and the development of cost effective business applications, the small business market place is ready to sky rocket. Obviously, it becomes important for everyone involved in the industry to gear toward this rapid growth.

During the last several months, we have seen several large companies make commitments to provide total systems to what was once referred to as the low end user. Large mainframe builders such as IBM, have already addressed the market place as they see it, by providing small systems for companies in the 1 million dollar a year category.

The market place as we see it, consists of the mom and pop type stores netting less than 150 thousand a year. There are thousands of these types of operations all over the country which can afford to and are anxious to automate. The road block up to this point has been the cost.

Now in 1978, just a little over three years after the first introduction of the so-called personal computer, we are seeing low-cost viable business machines coming of age. At the time of this writing, several manufacturers have announced their entry into the small business market.

The interesting point is that less than one year ago, the large system manufacturers considered small business as too small to be concerned with. The manufacturers of microcomputers had recognized the possibilities of the market at the beginning, and realized that it was only a matter of time before the application design would catch up with the hardware, making it possible to use the microcomputer in the business environment. Now the large system manufacturer is coming to the same realization and, due to marketing and manufacturing muscle, will be able to quickly overpower the market.

But where will it go, and how long will it take for the market to mature? We firmly believe that, by 1980, small business will be the mainstay of the microcomputer industry, with industrial control and home consumer applications battling for second place.

Here at INTERFACE AGE we feel it is important to keep abreast of this growing industry and report on what is happening.

Therefore, beginning with this issue, we have established this section dedicated to the small business world. Each month, within this section, we will provide stories covering what industry is doing to support the small businessman. We will also provide useful business applications for use on the microcomputer.

This editorial page will always be a standing feature and is open to anyone who has developed an expertise in small business systems. □

PHOTO 1 Unimate robots loading and unloading presses.

Robots in Manufacturing

By Ashok K. Nagrani

Aldous Huxley in his thought-provoking *Brave New World* saw a society in which standardized human products could be bred so as to facilitate the task of managers. Through the science of eugenics, bottled babies of various grades could be produced, including Bakanovsky groups of semi-morons. The morons would be conditioned at birth to love factory work and hate nature, books and recreation. Critics have commented that the hope of any brave new world is going to be science and technology, wherein science would work for man and not man for science. Science would be the ultimate unitive knowledge, the transcendent Godhead Brahma, working toward the Higher Utilitarianism. The conscience of man would be the religion of Higher Utilitarianism, transcending the Greatest Happiness Principle, wherein man's guiding principle would be, "How will this thought or action of mine contribute to, or interfere with, the achievement by me and others toward the attainment of ultimate realization?" Mankind may or may not be eventually guided by such lofty, mystical aspirations, but it is evident through the recent past that although various societies have at times tries to subvert such principles, the collective conscience of mankind has resisted the creation of human subclasses.

Aldous Huxley's version of standardized working bodies facilitating the job of managers is certainly appealing to mass producers. But instead of eugenics providing us with the standardized bodies, the mass of workers for the factories of the future may well be provided by the field of robotics. Science fiction writers in the past have fed the popular press with visions of all-knowing robots who would eventually replace man. The movie "Star Wars" had its lovable R2-D2 and the ever-plodding "our-fate-in-life-is-to-suffer" C3P-0. These robots moved, had feelings, could see and think, and performed all types of useful tasks. While the development of such advanced robots in the near future is remote, what is true but not very well known is the fact that robots are beginning to make inroads into factory life.

The word "robot" originated from the Czech novelist and playwright, Karel Capek, who in 1921 wrote the play "R.U.R.," a satire on the mechanization of modern life. The initials of the title stood for "Rossum's Universal Robots." It is this aspect of universal automation that is allowing robots an entry into the industrial field today. While semantists argue about what constitutes a robot, it is generally agreed that a robot has the following features: (a) It is anthropomorphic; (b) It is programmable for different tasks; (c) It is computer-controlled; (d) It has several degree of freedom of motion, and (e) it is reactive via feedback.

Today's industrial robot is a solution looking for a problem. There are over 6000 robots in world-wide use, 2500 of them in the U.S. They are being used for such tasks as material handling, machine loading, painting, arc welding, spot-welding, and a variety of other tasks which are either too boring or too dangerous for human beings. The notion of a relatively low-cost, programmable machine which can automate batch manufacturing has a tremendous appeal to industries looking for ways to reduce costs and increase efficiency. However, unlike the robots of "Star Wars," industrial robots are dumb, blind, unfeeling, and unable to think — prompting one wag to say that the reason he loved robots was

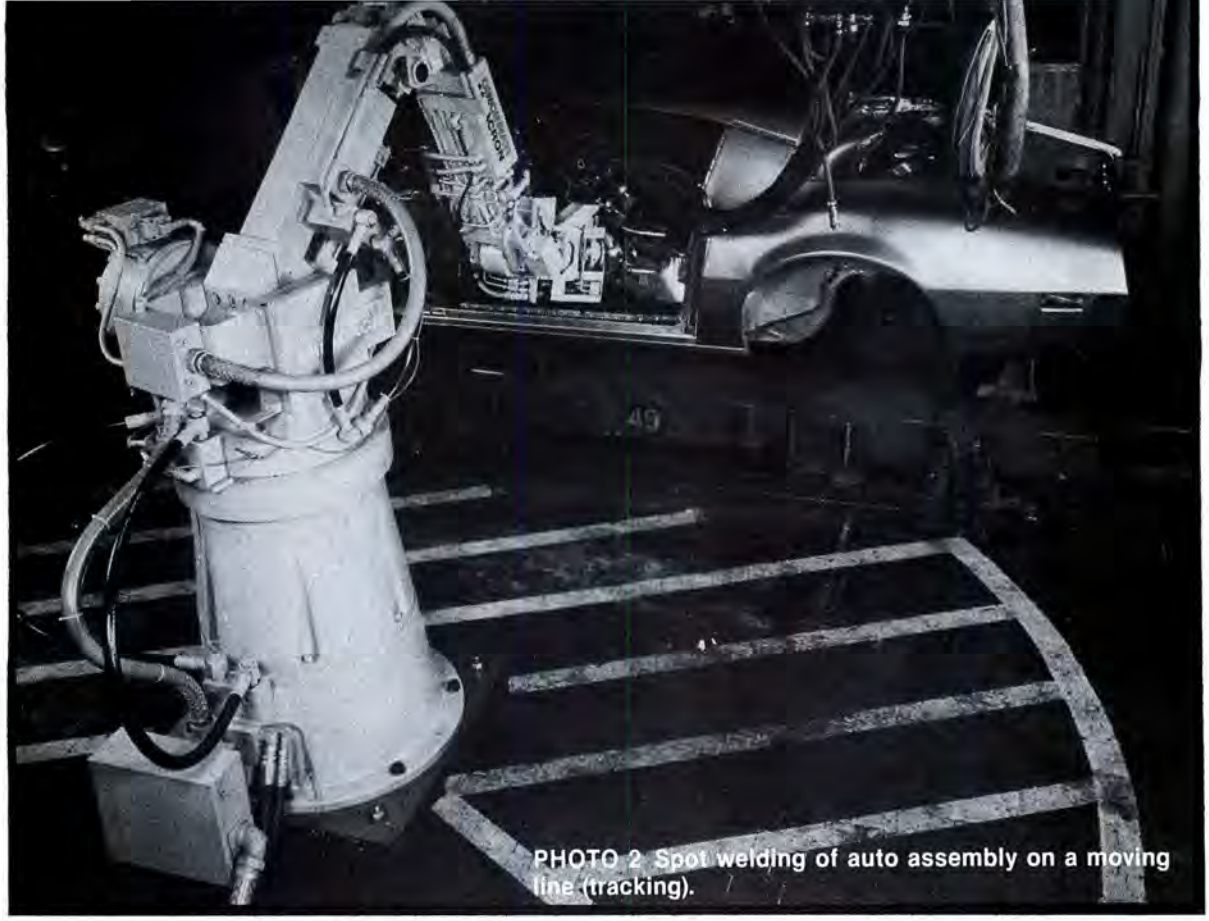


PHOTO 2 Spot welding of auto assembly on a moving line (tracking).

because they were so much like his spouse. The only difference, he claimed, was that robots, in most instances, followed his commands. Most assuredly, robots have just barely touched the surface of their potential use inasmuch as a large segment of industry has not yet been exposed to these new developments. Furthermore, the maze of claims and specifications of contemporary robots leaves the prospective buyer rather confused.

ROBOTIC TECHNOLOGY TODAY

Where should robots be considered? In order to answer that question, consider the machines that are available on the market today. A recent study identified over 200 manufacturers who produce devices that could be termed robots. Twenty-six U.S. manufacturers make robots that range from pick-and-place devices to the very sophisticated, minicomputer-controlled six-axes devices that can be interfaced to other computers to operate in real time. In the sophisticated sector, Cincinnati Milacron and Unimation are recognized for the superiority of their products and the extend of their commitment to the field.

Unimation introduced its first robot in the early 1960's and now has over a thousand units operating in industry. The Unimate robot itself comprises a turret-on-a-box and comes with arms having three to six degrees of motion. Special-purpose hands are available that can do a variety of jobs such as drilling, routing, deburring, arc welding, spot-welding, etc. The movements are actuated hydraulically, while the hands may be pneumatic. Programming is done by leading the robot through the required steps manually. Encoders on the arm extensions and joints transmit digitized positions which are stored in memory. The robot controller has the memory capacity to store up to 1024 steps, which is adequate for most simple jobs. Photo 1 shows the Unimate robots loading and unloading a press.

Cincinnati Milacron's robot, the CH6, has a jointed arm with six axes of freedom. It is totally hydraulically actuated and operates under minicomputer control, which allows it such versatility as tracking an object on a moving conveyor. It is also the most expensive, having a base price of around $85,000. Photo 2 shows the CH6 spot-welding an auto assembly. In an experimental setup, shown in Photo 3, the CH6 has a drilling head mounted on its hands.

A jointed-arm robot made by a Swedish Company, ASEA, is today perhaps the most accurate production robot available. Operating under minicomputer control, it is actuated by DC motors and exhibits accuracies in the order of ±0.010 inch, which is far superior to anything else on the market. Such accuracy does not come cheap. By the time all the necessary peripherals are added, the ASEA unit costs in excess of $100,000.

In the mid-range of the robotistic spectrum are robots such as the Prab, which is used chiefly to serve the metalworking industry. The Prab operates with four-motion axes and is hydraulically actuated. It is programmed by setting tabs on a rotating drum. The preset tabs trip switches which actuate the robot to perform its motions. Two specially designed units used for painting are the DeVilbus/Trallfa unit, which is programmed by walking the robot through the necessary steps and recording them on tape, and another tape-controlled unit marketed by a British firm called Binks.

The lower end of the spectrum has units which in the opinion of some experts should not even be called robots. These units have limited sequences which exhibit pick-and-place movements. Robots such as the Auto-Place, Auto-Mate, and Sterling-Detroit fall in this category. They are pneumatically actuated and use either air-logic or solid-state programming. Their lack of sophistication is reflected in their low prices, with some of the units selling for as low as $9,000.

Most of the robots are programmed to operate in an open loop where they repeat the same set of functions continuously without modification. As we mentioned earlier, the robots are programmed either by setting tabs — as in the simple robots, or by walking through, with the end positions being recorded in memory. Pro-

PHOTO 3 Drilling head mounted on Cincinnati Milacron robot being used for aircraft wing drilling.

grams can be either point-to-point or continuous path, where the entire motion is significant, as in painting.

LIMITATIONS OF PRESENT DAY ROBOTS

Attractie as the features are on off-the-shelf robots, certain limitations inhibit their widespread usage. A major limitation is the lack of absolute accuracy and repeatability. Most robot manufacturers cannot guarantee a repeatability any better than ± 0.050 inch for even the more sophisticated robots. Also, most programming is done by either walking a robot through the steps or by manually setting tabs for travel limits. In situations where small batch manufacturing is prevalent, this feature curtails the up-time on the machine. In addition, most applications require special-purpose hands and tools, and the lack of variety of standard types adds to the development time and cost. And not the least of the inhibitors is the high initial cost of the machines combined with a general unawareness of computer aided operations. Consequently, there is very little natural inclination to spend a substantial amount of money on an "iffy" proposition.

NEW DEVELOPMENTS

A mass of development work is in progress, however, to overcome many of the limitations inherent in present day robots. Spearheading this effort is the Air Force's Integrated Computer Aided Manufacturing Program (ICAM), which contemplates spending $75 million in the next five years. The Air Force likens its ICAM program to the $40 million investment it made in numerical control in the 1950's, which resulted in a multi-billion dollar payoff in increased productivity. The Air Force has as its ultimate goal the creation of fully automatic work stations and assembly cells, with computers interacting machines and robots to do the fabrication and assembly.

Among the tasks that have been identified are the improvement of accuracy, off-line programming with the development of higher level languages, hierarchical control systems to integrate robot systems into production units, and advanced sensory perception for reactive feedback loops.

THE IDEAL ROBOT

Nature has provided us with a unique model for an ideal industrial robot in the human arm and hand. The human hand is a powerful, yet delicate, tool which also serves as a receiving and transmitting sensory organ. Combined with the brain and vision, it has been a major factor in human evolution, making man both a tool maker and a tool user. The arm comprises two links, the upper and lower arm. It has six degrees of freedom. The arm-hand assembly is lightweight and strong, with a

Most robot manufacturers cannot guarantee. . .repeatability. . .most programming is done by. . .walking arobot through the steps or by manually setting tabs for travel limits.

strength-to-weight ratio of five. The materials of manufacture, muscle and bone, are strong, rigid and damage-resistant. The joints are essentially friction-free. They are instrumented for force, velocity and position, and the feedback is nonlinear, with increased sensitivity to small changes. Average positional accuracy of the arm is ± 0.040 inch. Muscles used to power the hand have low moment of inertia and no backlash. There is compliance in the overall structure, allowing overload protection.

There are several basic differences between the robots of today and the human arm. For example,

humans can work both arms simultaneously and have mobility, while robots cannot. However, efforts are in progress to overcome this difference. Kawasaki of Japan makes and uses robots that travel on an overhead monorail. Unimation has a prototype robot that has two hands that can be used for assembly jobs. Photo 4 shows the robot assembling an auto valve assembly. A single computer directs the two hands.

Another difference is in the strength-to-weight ratio. The best strength-to-weight ratio of the industrial robots is still less than unity. The other major difference lies in the compliance and control inherent in the human hand. There has been no compliance built into any of the robot hands so far; and as far as control of a robot hand is concerned, if sensory input signals were provided, the computer could provide the control required.

VISION RESEARCH

Quite a bit of work has been done on providing robots with vision. Black and white television cameras are used most often to provide the computer with an array image of brightness levels. The accuracy of the two-dimensional image depends upon the resolution of the camera. The array is processed with the intention of finding objects in it and distinguishing them from each other and the background. Two principal techniques are used to do this, both being based on gradient operation. The first is "edge finding," which assumes that discontinuity in local property exists between images of different surfaces. The gradient operator is programmed to find these locations. When the gradient operator is finished, the points determined to lie on contrast edges are linked together to outline the regions in the scene.

The other technique used is "region growing," which works on the assumption that the image of a surface is uniform in its local properties. The gradient operator clusters together points over which this is true. When all points which can be clustered together have been clustered, the process terminates with the outer points forming the cluster boundaries. Region growing is more expensive than edge finding, but produces more confident outlines.

After edge finding or region growing has been performed, property determination is done for such descriptives as shape of outline, region shading and its relationship to other regions in the scene. Popular analysis parameters are perimeter, area, maximal to minimal diameter ratios, the number of holes, etc.

Recognition of the object of the scene can be as simple as comparing the outline approximation and the calculated parameters with those stored in memory. If parts are recognized, their position can be determined and ensuing operations performed with correctional offsets introduced for out-of-position parts.

Two areas in which much development work is being done today are the automotive field and the aerospace industry. The U.S. auto makers already have a great number of robots on their assembly lines doing various jobs. Their strategy has been to go with proven technology and apply robots to the simplest assembly jobs without waiting for that ultimate robot that will be able to do everything. In the meantime, General Motors is also working with the robot manufacturers to achieve a robot that can interchange with a human on the assembly line.

GENERAL MOTORS' ROBOT ASSEMBLER

General Motors calls its new robot PUMA for Programmable Universal Machine for Assembly. The unit will be lightweight so that when repairs are needed it can be pulled off the line and replaced with another robot or a human. Computer-controlled and the size of a human arm, the robot will offer a bridge between manual assembly and special-purpose, expensive, hand automation. Human operators will perform alongside during complex operations to ensure that it is doing its programmed job. General Motors estimates that 95 percent of its parts weight less than three pounds, hence a robot that can carry seven and a half pounds would be adequate for most jobs. Assembly lines are being conceived using half a dozen programmable robots in making small assemblies. A product change would obviously create problems with part feeding and orientation devices, and it is hoped that further development in computer vision can possibly create a degree of universality that will make economically reprogrammable assembly cells a reality.

AEROSPACE ROBOTIC APPLICATIONS

Aerospace companies, on the other hand, are chiefly concerned with large sheet metal assemblies. The major airframe manufacturers have either acquired robots or else they are in the act of buying one. General Dynamics in Fort Worth proposes to use robots for the drilling and routing operations on the F-16 airplane wing. Lockheed-Georgia Company of Marietta, Georgia, has an ambitious program of assembling cargo floor bulkheads with robots. The techniques developed by Lockheed will eventually be used to assemble entire fuselage side panel and top panel assemblies. Boeing and McDonnell-Douglas also have similar plans for introducing robots in their fabrication and assembly operations.

CONCLUSION

What does all this development in robotics mean to the small businessman in terms of reduced costs and increased efficiency? If the parts that he makes are large and complex enough to require sensory perception, there is, unfortunately, very little that he can presently buy off-the-shelf. That is not to preclude what could happen in the future. Virtually every present application in the field has been specially engineered, entailing much associated development effort and high cost. But if the small businessman has several people doing batch-type work all day on pick-and-place operations, or if he has several spot-welders working on small batch lots or painters painting a variety of similar parts that vary from day to day, an investigation into the simpler robots would be well worth his effort. With labor rates on the increase, he might easily justify investing from $10,000 to $50,000, depending on the size of his business.

AND FINALLY

Every new worksaving breakthrough has had its associated prophets of doom who fear that man will soon make himself obsolete. The use of robots has brought up some very lively discussions about the fears of massive unemployment and redistribution of work. While sociologists ponder such situations, a cursory look at American history will show that these fears are pretty groundless. Although there has been redistribution in the past, the trend has always been toward a better standard of living. The young lady who spends my money, (YLWSMM), ruefully remarked that when we had robots who could cook and clean and mop and mow I wouldn't need her anymore. However, robots are not quite ready to replace the house mate yet. As it stands, even the most advanced robot has a maximum vocabulary of only about 75 words, which slightly hinders intelligent conversation. Further, I have yet to see a robot break into a smile or have its eyes light up when it sees its master. And even when the day of such accomplished robots arrives, YLWSMM needn't worry. She neither cooks nor cleans, nor does she mop or mow; but I do have her programmed for good conversation, a pretty smile, and a few other things! □

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Mail Code Sort and Print Program

By Jim Huffman

At some time or another, every small business probably wishes to generate some kind of mailing list. If the business is fortunate to have a bulk mailing permit from the U.S. Postal Service, it will find itself arranging the envelopes, catalogs, or whatever is to be mailed, in zip code order, tying these together in bundles as set forth in the U.S. Postal Service requirements. For this reason, I have written the mail code sort and print program. The program takes a little while to operate, but that really doesn't make that much difference, as it can be put into operation and left alone to generate a mailing list. When used in conjunction with the alphanumeric strip printers, such as the SWTPC PR-40™, it generates nice mailing labels at just about the right size to be stuck to envelopes, or whatever, to aid in the bulk mailing.

The listing is given in Program 1. The program has the ability to sort to the first number of the zip code, first two numbers of the zip code, first three numbers of the zip code, first four, and even all five numbers of the zip code. It will output the names in total zip code order as far down as one wishes. Keep in mind, however, that the further down you wish to sort the program, the longer it will take the program to assemble your mail code listing. Mail codes are generated from data statements, i.e., look at data statement 0100. The data statement is made and contains the name, address, city, state, and zip. Each portion except city and state are separated by a comma.

The program listing is shown as giving a two digit sort. To adjust for a three digit sort, change step number 9010, 9210, and 9215 so that the constant is equal to 100 instead of 1000. For a one digit sort, you would use 10,000; for a four digit sort, you would use 10; for a five digit sort, or to put all the zip labels in perfect zip code order, you would use 1 as the constant. In this program, it would take an excrutiatingly long time to generate any sizable mail code list. The reason data statements were used instead of strings was because of the limited string handling capabilities of most microprocessors. Although this causes the program to have to take a longer time to generate the mail code sort, it at least makes it feasible.

Notice steps 8000 through 8070. This is a simple program which may be removed should your data statements ever reach the 800 statement mark. Steps 800 through 8070 are used strictly to read out the data statements as they are entered to that any errors in data statements can be taken care of. An error in the data statement, such as overloading too many string characters in a field, can throw off the entire program and cause improper sorting of the program.

Since data statements are used and the data must be read and then stepped, and then read and then stepped, one must make sure all his data statements are correct before running the program. You might generate three-fourths of your mailing list, run into an error, and you would just have to start the entire program all over again. There would be no way to resume reading at the point where you stopped, unless your BASIC is capable of doing it; then you would merely re-enter the program at some point, like 9020 instead of hitting run again, which would initialize all the data and restore the data read operation. That would be bad news.

After all the data statements are entered and then checked, by using the routine at step 8000, the program can be run; and it's just a matter of walking away.

The program as shown runs in 8K BASIC with an additional 4K of RAM for program storage. However, if you had a very long list of names, you would have to add an appropriate amount of RAM memory to handle the data statements.

Figure 1 shows the data statements that were abbreviated in the program listing. Beginning at 0100 is a partial customer list. Figure 2 shows a printout of a mail code sort down to three digits of these same names that are included in the data statements. □

Figure 1.

```
0100 DATA ROGER A STEIL, 520 30TH ST SE,
CEDAR RAPIDS  IA,52403
0110 DATA THOMAS HAHN, 135 UNION ST SO.,
WEYMOUTH  MA,02190
0120 DATA RAYMOND W SHORT, PO BOX 1306,
GILLETTE  WY,82716
0130 DATA JOHHN WILLIFORD, RT 1 BOX 40,
JONESBORO  TN,37659
0140 DATA JERRY L MEANS, 1715 DAKOTA,
LEAVENWORTH  KS,66048
0150 DATA BL FRED, 25W 632 FLINTCR RD,
WHEATON  IL,60187
0160 DATA ALFONSO CUEVAS, 1825 HORNE RD,
CORPUS CHRISTI  TX,78416
0170 DATA JOHN GUYMON, 7829 DUNGAN RD -B,
PHILADELPHIA  PA,19111
0190 DATA FRED GEISER, 527 RYAN, THERMO
POLIS  WY,82443
0200 DATA J W CROWE, RR 1 BOX 602, STONING
TON  CT,06378
0210 DATA MASON BOULDIN, 552 ALHAMBRA AVE,
FRANKFORT  IN,46041
0220 DATA ROBT G STERN, BOX 575, MARARITA
CANAL S,00000
0230 DATA RONALD D MCNITT, 590 MAINT CO BOX
E, ALBROOK  AAF,09825 APO
0240 DATA C A MIRABELLA, 4610 ORCHARD ST,
PASAGOULA  MS,39567
0250 DATA R CARRY, 93-14 242 ST, BELLEOSA
NY,11426
0260 DATA W J DEMARSHE, 1860 OBRIEN AVE,
BRONX  NY,10473
0270 DATA K KAYNOR, 10805 LLOYD DR, WORTH
IL,60482
0280 DATA EM GRIFFITH, 1324 9TH ST,
CORONADO  CA,92118
0290 DATA L CANNON, 2842 STANLEY AVE, N
LAS VEGAS  NV,89030
0300 DATA FD CICATELLO, 111 NORDEN ST,
STATEN ISLAND  NY,10304
0310 DATA LEONARD POWELL, 2428 REIMS RD,
LEXINGTON  KY,40504
0320 DATA JOHN STOFAN, 339 WASHINGTON ST,
FREELAND  PA,18224
0330 DATA G L KLEITS, 90 BELVEDERE DR,
YONKERS  NY,10705
0340 DATA LEMUEL BALLARD, PO BOX 236,
POTEAU  OK,74953
0360 DATA E L ROOT, 12469 HAYFORD ST,
NORWALK  CA,90650
0380 DATA V KABACINSKI, 738 S MAIN AVE,
SCRANTON  PA,18504
0390 DATA A WATTENMAKER, 222W 83 ST,
NEW YORK  NY,10024
0400 DATA G HARMON, 3017 J MADISON DR,
BILOXI  MS,39531
```

PROGRAM 1

```
0005 REM MAIL CODE SORT & PRINT
0010 REM BY JIM HUFFMAN
0020 REM JAN 8, 1976
0030 REM

0040 RESTORE
0050 GOTO 9010

0100 DATA ROGER A STEIL, 520 30TH ST SE,
CEDAR RAPIDS  IA,52403
0110 DATA THOMAS HAHN, 135 UNION ST SO.,
WEYMOUTH  MA,02190
0120 DATA RAYMOND W SHORT, PO BOX 1306,
GILLETTE  WY,82716

ETC, ETC

9000 DATA 0,0,0,0
9010 LET Y = 100
9020 READ N$,A$,S$,X$
9030 IF N$ = "0" THEN 9200
9040 IF VAL(X$)< = Y THEN 9300
9060 IF Y>10000 THEN END
9070 GOTO 9020
9080 PRINT N$
9090 PRINT A$
9100 PRINTS$,X$
9110 PRINT
9130 GOTO 9020
9200 RESTORE
9210 Y = Y + 100
9215 X = Y - 100
9220 GOTO 9020
9300 IF VAL(X$)> = X THEN 9080
9310 GOTO 9020


8000 RESTORE
8010 READ N$,A$,S$,X$
8020 PRINT
8030 PRINT N$
8040 PRINT A$
8050 PRINT S$,X$
8060 INPUT A$
8070 GOTO 8010
```

SAMPLE RUN

```
ROBT G STERN
BOX 575
MARARITA CANAL S  00000

THOMAS HAHN
135 UNION ST SO.
WEYMOUTH  MA  02190

J W CROWE
RR 1 BOX 602
STONINGTON  CT  06378

RONALD D MCNITT
590 MAINT CO BOX E
ALBROOK  AAF  09825 APO

W J DEMARSHE
1860 OBRIEN AVE
BRONX  NY  10473

FD CICATELLO
111 NORDEN ST
STATEN ISLAND  NY  10304

G L KLEITS
90 BELVEDERE DR
YONKERS  NY  10705

A WATTENMAKER
222W 83 ST
NEW YORK  NY  10024

R CARRY
93-14 242 ST
BELLEOSA  NY  11426

JOHN STOFAN
339 WASHINGTON ST
FREELAND  PA  18224

V KABACINSKI
738 S MAIN AVE
SCRANTON  PA  18504

JOHN GUYMON
7829 DUNGAN RD -B
PHILADELPHIA  PA  19111

JOHN WILLIFORD
RT 1 BOX 40
JONESBORO  TN  37659

C A MIRABELLA
4610 ORCHARD ST
PASAGOULA  MS  39567

G HARMON
3017 J MADISON DR
BILOXI  MS  39531

LEONARD POWELL
2428 REIMS RD
LEXINGTON  KY  40504

MASON BOULDIN
552 ALHAMBRA AVE
FRANKFORT  IN  46041

ROGER A STEIL
520 30TH ST SE
CEDAR RAPIDS  IA  52403

BL FRED
25W 632 FLINTCR RD
WHEATON  IL  60187

K KAYNOR
10805 LLOYD DR
WORTH  IL  60482

JERRY L MEANS
1715 DAKOTA
LEAVENWORTH  KS  66048

LEMUEL BALLARD
PO BOX 236
POTEAU  OK  74953

ALFONSO CUEVAS
1825 HORNE RD
CORPUS CHRISTI  TX  78416

RAYMOND W SHORT
PO BOX 1306
GILLETTE  WY  82716

FRED GEISER
527 RYAN
THERMOPOLIS  WY  82443

L CANNON
2842 STANLEY AVE
N LAS VEGAS  NV  89030

E L ROOT
12469 HAYFORD ST
NORWALK  CA  90650

EM GRIFFITH
1324 9TH ST
CORONADO  CA  92118
```

An Overview

Designing A Small Business

By William L. Colsher

Everyone is talking small business systems. Yet, nobody has given much thought to what the components of this system should be. Bill has addressed the problem, as it relates to the entrepreneur involved in selling small business systems.

This article is also a useful guideline for anyone thinking of using micro-based business systems.

—Editor

Thinking about using your home computer for business applications? Great! Have you decided on what additional equipment you will be needing? No? Well, read on. In this article we'll take a look at some of the things you'll surely need and some you might not, but when we're through you'll have a pretty good idea of the kind of hardware investment you'll have to make to handle the business world.

The first thing you will need is a reliable system. You say your system is reliable? Will it run for twelve hours a day five days a week, without an error? If not, you'd better get it into shape, because that's the kind of environment it could be working in. Of course, only a few businesses will run a small computer that much but you should always plan for the worst case you can think of and then make it thirty percent worse. Equipment failures will keep you and your clients up late working things out. A couple of 5:30 A.M. crashes and your clients will be going to IBM.

The CPU and the other stuff inside the cabinet are not the only things that must be completely reliable. The peripherals attached to the system must also be as solid as the computer itself. Look carefully into each component you are planning to use before buying it. A good way to find out if a product is reliable is to ask around. One place to start is your local computer club. There will probably be at least a couple of members who are also setting up business systems. They'll be able to tell you if Company X's disk drive overheats after five hours and warps the disk or if Company Y's printer needs to be lubricated every two days. Another place to get information is from the company itself. In the mainstream software business the companies that produce software packages often distribute the names of other users of a particular package to prospective clients. That way the prospective buyer can find out exactly how good a given product is and if there are any little quirks a user should know about. I haven't called up Shugart or PerSci, but a little digging along these lines will probably yield more information than you really need. Remember, if one component blows, the rest are so much scrap.

Now let's take a look at the individual components that make up a system, from CPU to the paper for the printer. Since it's the heart of your system, let's start with the CPU. The first thing to do is forget about the chip being used. What we really want to know is if there is good solid software available to support it, and what kind of support it comes with (we're talking about cabinets, power supplies, etc. now).

Speed is not terribly important. Most business processing consists of reading in a record, moving the data around, and then printing it out. You'll almost certainly be limited by the speed of your peripherals rather than your CPU. One thing that is important is cosmetics. Given two similar systems, the pretty one will be easier to sell. An example might help on this. If you get the chance, compare an IMSAI and a Digital Group side by side. That IMSAI would look right at home in a laboratory or factory. Sure, it looks just like a real computer, but it doesn't really fit into an office environment. Now take a look at the Digital Group system. A nice neutral cabinet, clean design with no sharp corners, no flashing lights to distract and only two switches on the front. "Hmmm," says the client, "only two switches. It couldn't be very hard to use."

The most important thing is software. You can always hide all those switches and lights in a desk-type unit or have a custom cabinet built.

The next thing to think about is memory. You will need a lot. Probably more than you think you do. Also, remember that your clients' needs will change as they begin to see all the different uses they can put their computers to. Those new uses will almost certainly need more memory and guess who'll have to put it in. This brings up a little service hint: put in all the connectors that the motherboard will hold. In fact, the mainframe should be a maximum configuration setup all around. This will save you from going in with your trusty soldering iron just to add another 8K. All you'll have to do is plug in another card; be it memory, a new controller, or whatever.

How much memory will you need? About 40K will be the absolute minimum, especially if you are using software in BASIC. The main reason for this is the nature of business program. Many of the programs will have large tables. Tax tables, pay scales and the like will require big chunks of memory. If by change a program uses only a few small tables, it will probably have dozens of headings for the different reports it puts out. Error messages will also take up memory and they are an indispensable part of the programs you will sell.

The speed of the chips you use will not be important, but the power consumption will be at least a consideration. Remember that an inadequate power supply can contribute to unreliable operation, something to be avoided at all costs.

The other part of your business system's memory is mass storage. The type of mass storage you choose will, to a large extent, determine the capabilities of the entire system. The reason for this is quite simple. If, for example, the mass storage device is too slow for sorting efficiently, the files must be created sequentially and all data must be entered in order, i.e. it must be sorted by hand before being entered. This will tend to limit the sale of your system to clients who have relatively small DP requirements.

Now we come to one of the real sore points among hobbyists today: full size versus mini-floppies. It appears on first glance that mini-floppies are the best bet because of their very low cost. A little more careful look will show that depending on the application, this may or may not be true. The numbers seem to indicate that the mini-disks are just too slow for indexed access and sort-

ing. They also have a rather limited storage capacity. For only about one third the capacity and one sixth the speed of the full size floppies, they really aren't worth the lower cost. A real world example might be of help here. At the time of this writing the Digital Group dual floppy systems are priced at $1545.00 for the 8-inch disks and $1145.00 for the minis. That price, by the way, is for interface, drives, and cabinet fully assembled. Thus, for two thirds the price you get only one third the capacity.

Software bugs are far more common than hardware ones, and you will find that even the most thoroughly tested program will develop a bug as soon as a user gets his hands on it.

For those low end applications that do not require direct access to data, controllable tape drives such as the Phi-Deck offer an attractive alternative. Two Phi-Decks with a controller will run about $700.00 or so right now and they are reasonably fast. There is also a fair amount of software available that supports them, particularly from Digital Group.

One of the most important selling points of your system will be the printer. There are two main reasons for this. One is that the businessman will want a printer that will fit in with the office environment. This means fairly quiet and reasonably good looking. The other reason is that the printer is the interface between his business and the general public. A teletype gives a rather poor impression of a business. Dot matrix printers are little better, even though they may print both upper and lower case. A standard line printer is awful because it is ugly looking, both physically and in the kind of output it produces, and it is very noisy. In my opinion, you can't beat an IBM Selectric type printer for quality output.

There are some problems with a Selectric. It is rather slow for large amounts of output. This can be easily solved by having one large central printer and having your clients send you their output on a floppy disk or a tape and then print the stuff for them overnight. This gets you into some more problems with scheduling and the like, but it is one way of solving the problem for the businessman. You could also provide a second printer with the system for that volume printing, if the application required it on a daily basis. For weekly or longer periods, (monthly and quarterly are most common), the central printer idea sounds good in terms of cost to the client, (it's silly to have a $12,000.00 printer on a $3,000.00 system), and servicing problems. It's easier to get service, (or do it yourself), on one printer than on twenty. That brings up one of the big problems with Selectrics. They are quite reliable if they are perfectly adjusted. That adjustment is not for amateurs to make. Fortunately, there are a lot of places you can get Selectric maintenance contracts.

You may have noticed that I haven't mentioned video displays yet. Well, that's because there really isn't a whole lot to say about them. Size is very important. Those 9-inch monitors are just about the minimum size you can get away with. If the businessman goes blind from eye-strain, and can't see to sign your monthly check, you've got the wrong monitor.

I've been talking monitors because I believe that they are a better deal than the video terminals available on the market. Not only do they cost less, but you can also write better software drivers for them. Good data-entry software is an important part of the total system. The ability to fully control a display, easily changing any part of it, is an important feature.

The keyboard you use for data entry is also important. The extra cost of a $200.00 keyboard is easily justifled when you look at the price of video terminals, and an easy-to-use keyboard makes the job of entering data a lot lighter.

Now we come to the second main part of the system: the software. Just as hardware breaks down into two main divisions, (CPU and peripherals), software can also be divided into two sections: systems and applications. Generally you won't have to worry too much about systems software since it will be supplied by the manufacturer. If you discover a bug in a BASIC interpreter, the best thing to do is report it to the company you bought the BASIC from and then wait for them to give you a fix. This is the way it is done on large scale systems, and there is no reason not to do it the same way on micros.

Applications software, though, is your worry and it can be one of the biggest problems you will face. Software bugs are far more common than hardware ones, and you will find that even the most thoroughly tested program will develop a bug as soon as a user gets his hands on it

Almost the only way to handle applications software is to buy a package, (once again, check with other users to find out what's best), and then hire a programmer or two to make modifications for each your clients' special needs. Getting too carried away with custom programs can be very dangerous, so it's best to limit it to report formats or reporting periods; that sort of thing.

Even the largest companies live with packaged software, so it won't hurt you or your clients to go that route. It is simply too time-consuming and therefore expensive to develop a complete system of any kind on an individual basis.

There you have an overview of the main parts of a business computer system: processor, peripherals, and software. When you decide to start setting up a prototype system, remember that each piece of equipment must first be capable of doing the job you have in mind plus a little, then it must be reliable, and last it must be serviceable. These three things apply just as well to the software you plan to use. A fact that is often overlooked.

As in everything else, over-design is the best bet. This policy of buying the best components rather than the cheapest you can get by with, and putting in more capability than you ever think you can possibly use will save you more in the end than any short cut or "good deal" you can possibly make.□

Card-of-the-Month

Cost-Effective Logic Analyzer for the S-100 Bus

By Roger Edelson, Hardware Editor

The *Bus Grabber* is not, obviously, the first addition I would recommend for your computer installation. However, if you are developing your hardware or writing machine language software, the Model 150 is sure nice to have around. *Bus Grabber* is also very useful for trouble shooting day-to-day problems which occur in most microcomputer installations.

The Model 150 *Bus Grabber* is a dedicated S-100 Bus compatible logic analyzer, and as such provides several features not previously available in a multi-purpose logic analyzer. With the Model 150, 56 key S-100 Bus signals are available to the logic analyzer without the need for inconvenient interconnecting probes. The *Bus Grabber* accomplishes this by virtue of the fact that the device resides on a single board plugged into any available slot in the S-100 Bus motherboard. The computer system also provides the power for the analyzer, allowing a reduction in parts count and cost. In addition, the Model 150 can also be used to monitor eight additional user-defined signals through the use of a plug-in flat-ribbon cable probe assembly.

Let's take a look at the specifications of the Model 150 *Bus Grabber* before we discuss the construction and operation of the device. As mentioned, the Model 150 is a one-board S-100 Bus compatible unit with a remote hand-held control pod. Power is obtained from the computer system — 700 ma of + 8V DC and some 50 ma of + V DC. The Model 150 provides on-board regulators as is standard for S-100 Bus boards.

The Model 150 provides data domain, (versus time domain), analysis in either an octal or hexadecimal binary grouping. The data format is user selectable through a switch on the control pod. The display size is 8 bits, (one byte), wide by 16 words deep. The memory size, however, is 16 bits by 16 words. The lower address byte is always stored along with the inout data group selected. The trigger word may be up to 24 bits wide — all 16 address bits plus the eight selected input signals. Triggering may be set up for either a "1" or a "0" for the 16 address lines and a "1," "0," or "X" (don't care) for the eight data input lines. An LED on the control pod indicates "trigger Ready" and the trigger word is intensified in the display. A trigger output is provided for triggering an oscilloscope when a valid trigger word has been detected. This feature is particularly useful when the problem is due to logic glitches.

The control pod also allows the selection of eight different groups of eight signal lines. Seven groups are from the S-100 Bus: Lower Address Byte, Upper Address Byte, MPU Data Input, MPU Data Output, MPU Status, MPU Interrupts, and MPU Control. The last group of eight signals are the external signals obtained by using the color coded data input probe.

The data to be displayed may be collected in either positive time, (after the trigger word), or negative time, (prior to the trigger word). The display modes may be either single (snapshot) or repetitive. These functions are all selectable from the hand held control pod. The data collection

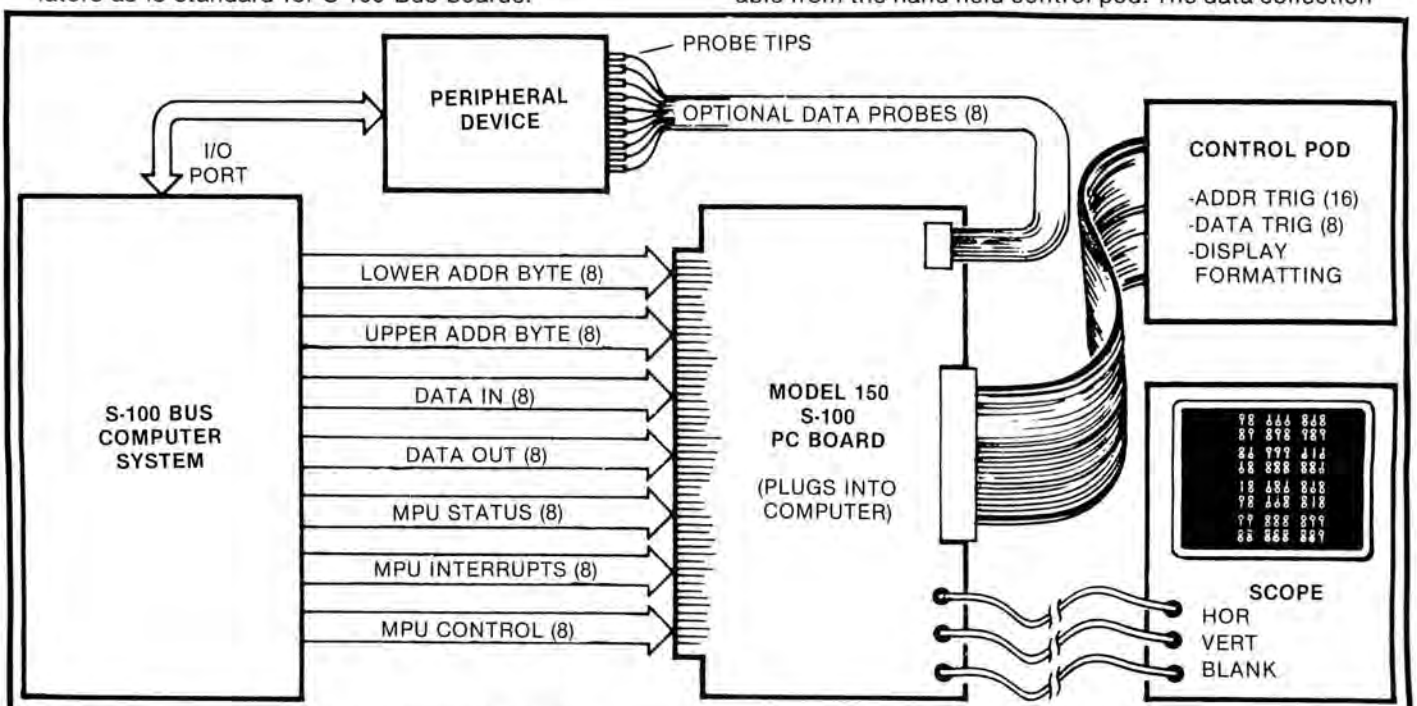


Figure 1. The Model 150 in a typical S-100 bus application. Optional data probes permit peripheral devices to be analyzed as well.

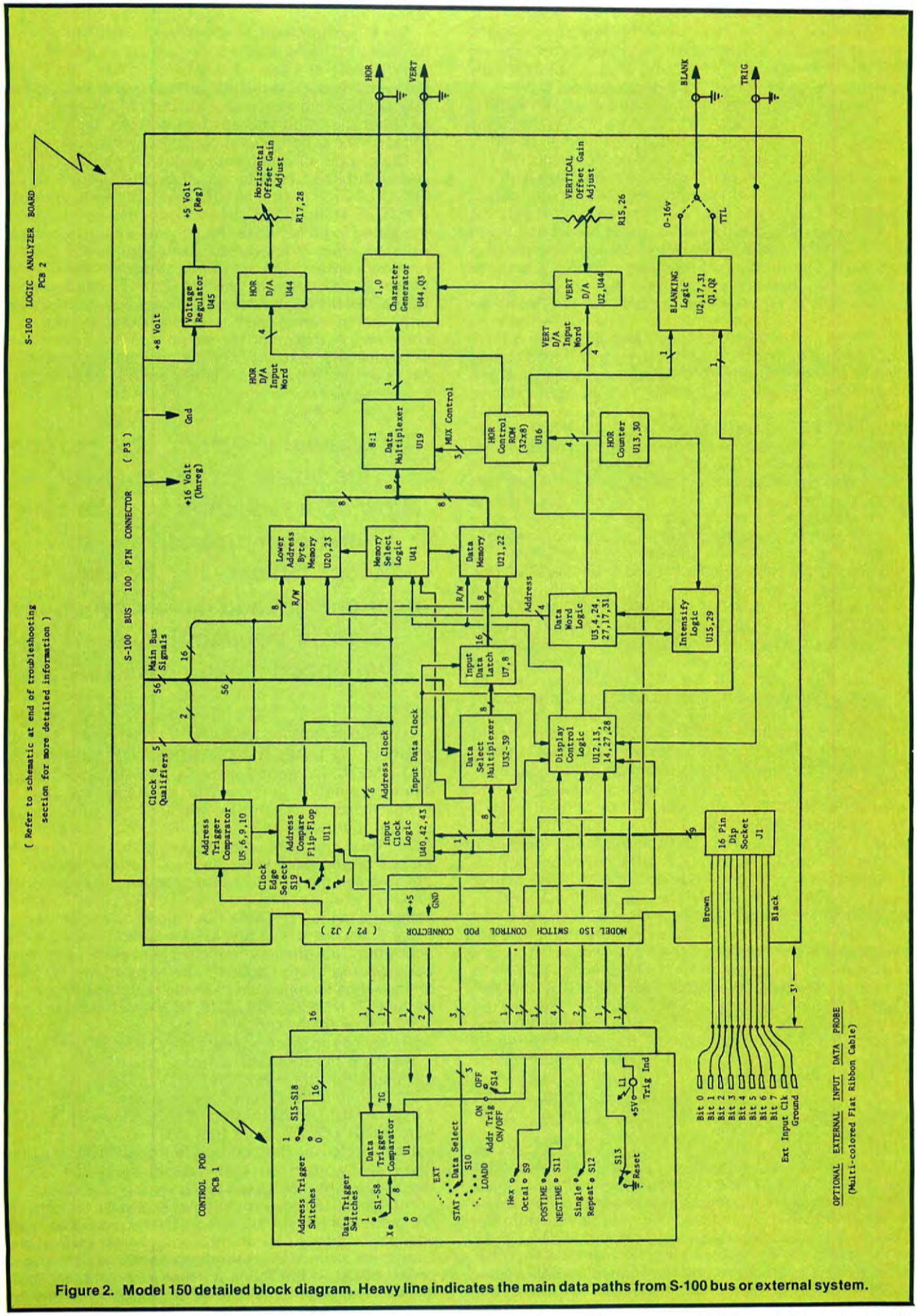


Figure 2. Model 150 detailed block diagram. Heavy line indicates the main data paths from S-100 bus or external system.

rate is greater than eight megabytes per second.

The polarity of the clock pulse provided by the S-100 Bus machine is automatically selected as appropriate for the selected data group, and is also automatically qualified with the other S-100 Bus signals.

The input logic levels are compatible with either TTL, DTL, CMOS, etc. (Logic "0": -0.5V to + 1.6V, and logic "1": + 1.6V to + 15V). The input signal loading is 400 ua max. for logic "0" and less than 100 ua for a logic "1." The input threshold is set at + 1.6V to be compatible with TTL logic. The Model 150 also provides a blanking output with selectable levels (to + 16V) and selectable polarity.

To understand the operation of the Model 150 it will be necessary to refer to the overall system diagram (Figure 1), the detailed block diagram (Figure 2), and the Schematic Diagram (Figures 3 and 4).

Referring to Figure 1, we can see that the *Bus Grabber* is divided into two printed circuit boards — the complex 4-layer S-100 plug-in card, and a simpler 2-layer wired in board for the control pod. As mentioned earlier, the 56 signals from the S-100 Bus are picked up at the main board's edge connector (P3). The signals are grouped into seven 8-bit bytes by the action of the DATA SELECT MULTIPLEXER (U32-U39) as shown in Figure 2. The multiplexer then outputs the selected 8-bit data group to the INPUT DATA LATCH (U7, U8). The data group selected is determined by the position of the DATA SELECT SWITCH on the control pod. When in position "EXT" the external eight signal lines are selected.

To assure proper state recognition, any logic analyzer must use the correct clock polarity to latch in the data signals. As the data signals derived from the S-100 Bus have known clock polarities, it is possible to provide a logic signal from the DATA SELECT SWITCH to command the INPUT CLOCK LOGIC (U40, 42, 43) to choose the appropriate clock polarity (rising, or falling). As the external signals do not have a predetermined clock polarity, the polarity of the clocking signal must be definable by the user. In order to do this an independent CLOCK POLARITY SELECT switch is provided on the main printed circuit board. This switch is always set to the negative (falling) position for the S-100 Bus signals. The board logic then selects the appropriate polarity.

Latched 8-bit data words are stored sequentially into the Model 150's 8-bit x 16-word DATA MEMORY (U21, U22) upon command of the DISPLAY CONTROL LOGIC (U12, U13, U14, U27, U28) and the triggering logic consisting of the DATA TRIGGER COMPARATOR (U1; located on the control pod PC board); the ADDRESS TRIGGER COMPARATOR (U5, U6, U9, U10); and the ADDRESS COMPARE FLIP FLOP (U11). Four, 4-bit DIP switches (S15-S18) on the control pod determine the 16-bit address which must occur on the address bus before the Model 150 will trigger. If desired, the user can turn all 16 switches off using the ADDRESS TRIGGER ON/OFF CONTROL (S14) on the pod. This feature is useful when using Model 150's external data input probes on non-related digital equipment and the triggering of the unit on a specific address of the S-100 Bus microcomputer system has no meaning. The OFF position of this switch is also useful for collecting and analyzing random 16-word truth tables as a starting point for solving difficult S-100 Bus problems.

The eight DATA TRIGGER SWITCHES (S1-S8) provide combinatorial logic triggering, i.e., each switch can be set to "1," "0," or "X" (don-t care). These switches "qualify" the data grouping chosen for analysis by the DATA SELECT SWITCH on the pod. For example, if the ADDRESS TRIGGER SWITCHES are off, the MPU STATUS word (STAT) is selected, and the particular DATA TRIGGER SWITCH corresponding to MEMORY READ operations (Bit 7) is set to "1" (all others are "X"), then the Model 150 will trigger only when the first READ occurs.

The triggering logic also provides a TRIG output signal which is available as a sync pulse to an oscilloscope for real-time troubleshooting of glitches and timing problems associated with particular machine states. The TRIG output signal is a function of the occurrence of either the 16-bit address trigger word, the 8-bit data trigger work, or both, depending on which is enabled.

The manner in which data words are collected by the DATA MEMORY is determined by the DISPLAY CONTROL LOGIC. If the MODE SWITCH (S11) is in the POSITIVE TIME MODE, data collection begins when the triggering logic provides the collection start command. After 16 input clock pulses, collection stops and the memory contains the data word present at the time the trigger word occurred, plus the next 15 words. In the NEGATIVE MODE, the memory stores data continuously until the triggering logic provides the collection stop command. At this point, the memory contains the 15 data words leading up to the trigger signal, plus the particular data word present at the occurrence of that trigger signal.

The computer system also provides the power for the analyzer, allowing a reduction in parts count and cost. In addition, the Model 150 can also be used to monitor eight additional user-defined signals through the use of a . . .flat-ribbon cable probe assembly.

If the SINGLE/REPEAT SWITCH (S12) is in the SINGLE position, the DISPLAY CONTROL LOGIC prevents the DATA MEMORY from collecting new data so that the same information will be written over and over again on the oscilloscope screen. The writing speed is fast enough so that a flicker-free "snapshot" is displayed on the CRT. This snapshot will remain displayed until the RESET button (S13) is pushed, causing the address of the selected memory to advance to the next word location. At the same time, the DATA WORD LOGIC issues a command to the VERTICAL D/A which causes the beam to move down one row in preparation for the display of the next word. This process continues until all 16 words have been written on the screen. The trigger word appears brighter than the other words in the truth table as a result of the INTENSIFY LOGIC (U15, U29) which provides a rewriting feature: the trigger word is written over and over again 8 times so that it appears intensified on the CRT.

Blanking between characters is provided by the remaining bit of the HORIZONTAL CONTROL ROM. (This ROM functions as a microcontroller which controls the 8:1 DATA MULTIPLEXER, the HORIZONTAL D/A, and the BLANKING LOGIC). Note that if the BLANK output is not connected to the scope, the intensification of the first or last word in the truth table will *not* be lost and, in most cases, the display will still be highly readable.

The Model 150 goes together quite easily, though it is not quite a one night kit. The printed circuit boards are adequately marked for all the components. I would prefer that the value of the discrete components were placed on the board — but that's a minor quibble. I just don't like to have to continually refer to a parts list to find the

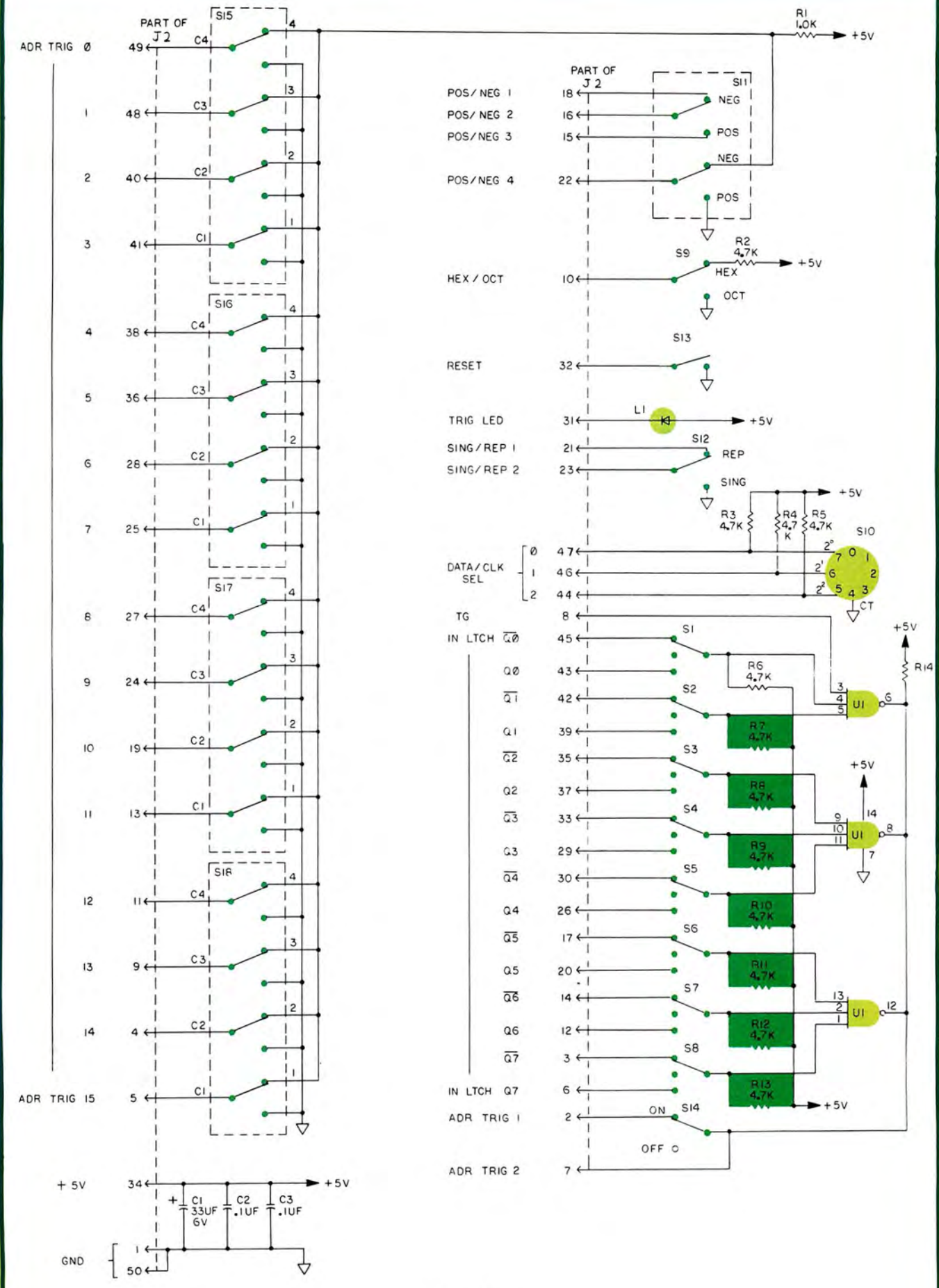
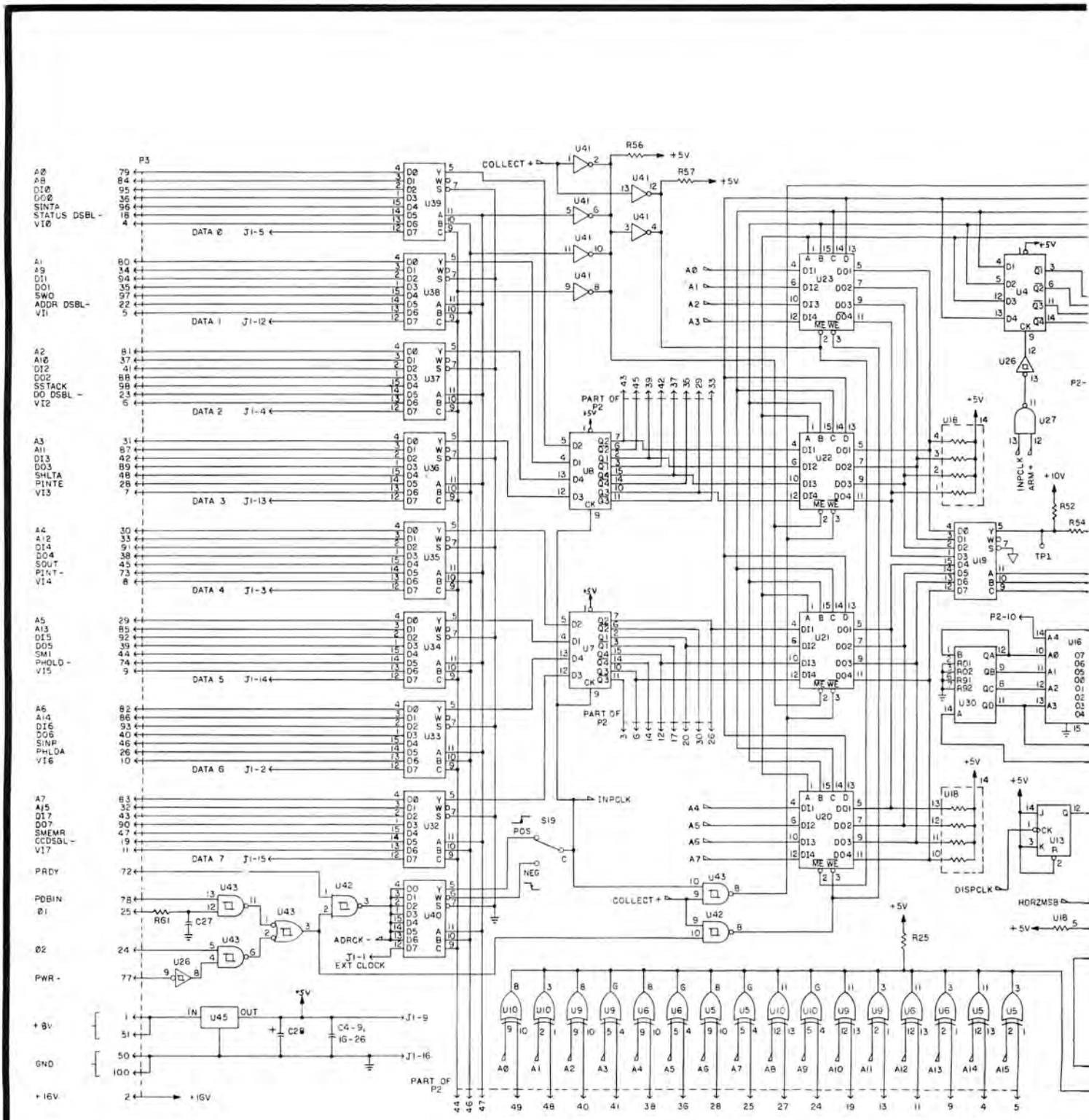
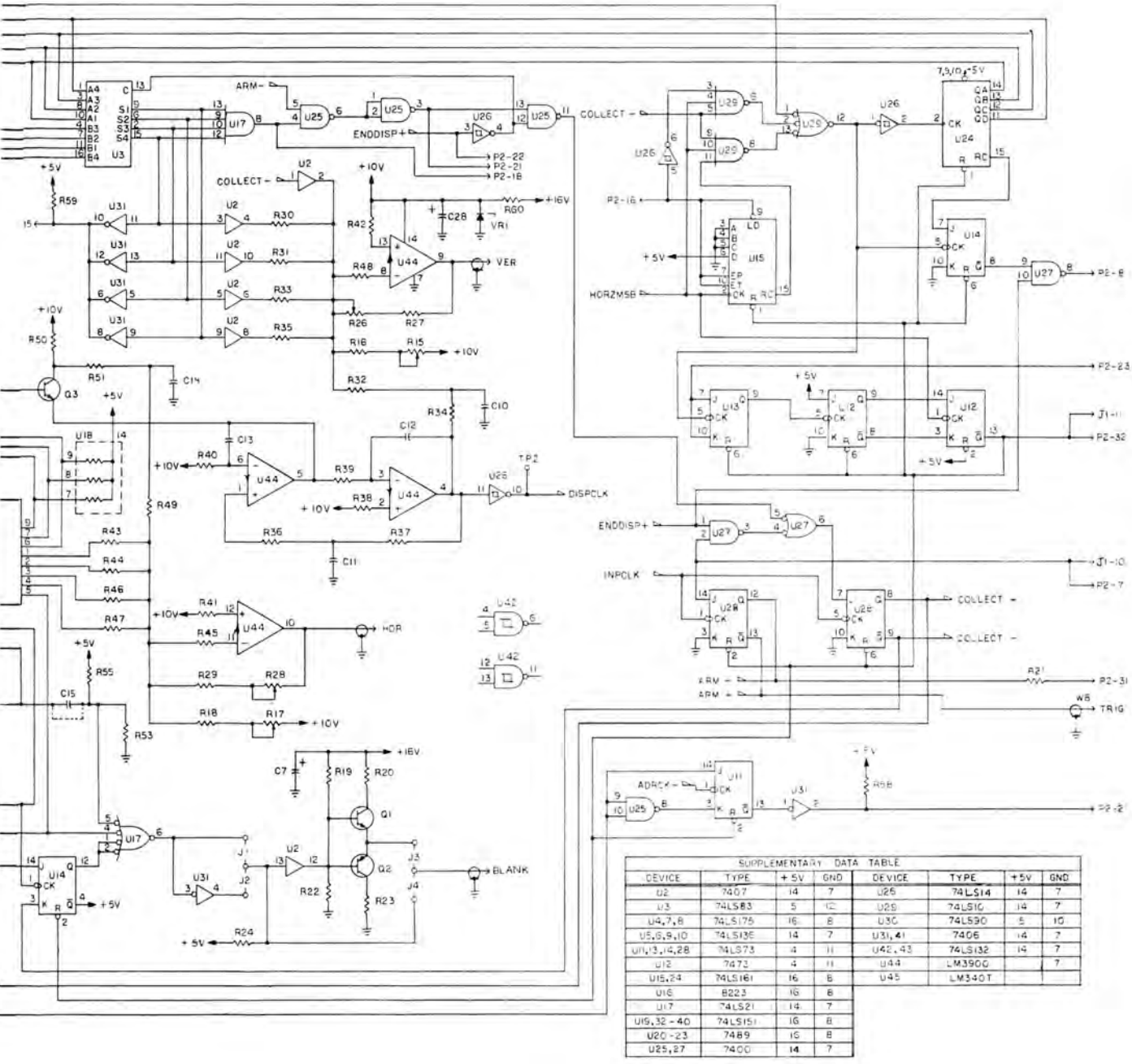

PART OF J2
S15
S16
S17
S18
ADR TRIG Ø
ADR TRIG 15
+5V
GND
C1 33UF 6V
C2 .1UF
C3 .1UF
R1 1.0K
PART OF J2
S11
POS/NEG 1
POS/NEG 2
POS/NEG 3
POS/NEG 4
NEG
POS
S9
R2 4.7K
HEX / OCT
HEX
OCT
S13
RESET
L1
TRIG LED
S12
SING/REP 1
SING/REP 2
REP
SING
R3 4.7K
R4 4.7K
R5 4.7K
S10
DATA/CLK SEL
CT
TG
IN LTCH Q0
IN LTCH Q7
ADR TRIG 1
ADR TRIG 2
S1
S2
S3
S4
S5
S6
S7
S8
S14
ON
OFF
R6 4.7K
R7 4.7K
R8 4.7K
R9 4.7K
R10 4.7K
R11 4.7K
R12 4.7K
R13 4.7K
R14
U1

Figure 3


P3
A0
A8
DI0
DO0
SINTA
STATUS DSBL -
VI0
A1
A9
DI1
DO1
SWO
ADDR DSBL-
VI1
A2
A10
DI2
DO2
SSTACK
DO DSBL -
VI2
A3
A11
DI3
DO3
SHLTA
PINTE
VI3
A4
A12
DI4
DO4
SOUT
PINT -
VI4
A5
A13
DI5
DO5
SMI
PHOLD -
VI5
A6
A14
DI6
DO6
SINP
PHLDA
VI6
A7
A15
DI7
DO7
SMEMR
CCDSBL -
VI7
PRDY
PDBIN
Ø1
Ø2
PWR -
+8V
GND
+16V
DATA Ø J1-5
DATA 1 J1-12
DATA 2 J1-4
DATA 3 J1-13
DATA 4 J1-3
DATA 5 J1-14
DATA 6 J1-2
DATA 7 J1-15
U39
U38
U37
U36
U35
U34
U33
U32
U40
U41
U42
U43
U45
U26
R56
R57
+5V
COLLECT +
ADRCK -
J1-1
EXT CLOCK
R61
C27
C28
C4-9,
16-26
J1-9
J1-16
IN
OUT
PART OF P2
U8
U7
U23
U22
U21
U20
U4
U18
U19
U27
U30
U16
U13
INPCLK
ARM +
+10V
R52
R54
TP1
P2-10
P2-
DISPCLK
HORZMSB
R25
S19
POS
NEG
U10
U9
U6
U5



SUPPLEMENTARY DATA TABLE

DEVICE	TYPE	+5V	GND	DEVICE	TYPE	+5V	GND
U2	7407	14	7	U26	74LS14	14	7
U3	74LS83	5	10	U29	74LS10	14	7
U4,7,8	74LS175	16	8	U30	74LS30	5	10
U5,6,9,10	74LS138	14	7	U31,41	7406	14	7
U11,13,14,28	74LS73	4	11	U42,43	74LS132	14	7
U12	7473	4	11	U44	LM3900		7
U15,24	74LS161	16	8	U45	LM340T		
U16	8223	16	8				
U17	74LS21	14	7				
U19,32-40	74LS151	16	8				
U20-23	7489	16	8				
U25,27	7400	14	7				

Figure 4

component value to place on the board. Also, the marking of the reference numbers of the components on the printed circuit board does little good after the board has been assembled, as the components then cover the marked designations.

The printed circuit board has gold-plated edge connectors for reliability and the circuit traces are tinned to make soldering easier. The solder masking is first rate, and I liked the use of the edge connector to attach the ribbon cable between the control pod and the main board. The ribbon cable is soldered into the control pod by means of a plug which is inserted into appropriate holes on the pod printed circuit board and then soldered. This makes a reliable and easy to assemble connection.

The control pod is also very easy to assemble, though some minor difficulty may be experienced when trying to line up the switches and the holes in the cover plate. At least one of the components referred to in the assembly manual (a switch with one mounting tab removed), was never found. I removed the offending tab myself.

The board is adequately filtered and the 5 volt regulator has its own heat sink. All in all the kit is easy to assemble—this is one in which I made no errors—and will present no problems to the average computer enthusiast.

The Model 150 goes together quite easily, though it is not quite a one night kit. The printed circuit boards are adequately marked for all the components . . . The solder masking is first rate. . . All in all the kit is easy to assemble . . . will present no problems to the average computer enthusiast.

Once assembled, it is necessary to check out the operation of the Model 150. In this phase of the assembly, the manual really shines. Over 12 pages of checkout instructions are provided. Before installing any of the integrated circuits, you are required to measure all the supply voltages to assure that they are within acceptable tolerance. Two pages alone are used to help you select the blanking level appropriate to your scope.

The manual then requires that continuity and voltage checks be made after the integrated circuits have been installed. In my case, everything went extremely smoothly with no glitches; the *Bus Grabber* worked perfectly with no problems. However, if you do run into difficulty, Paratronics has provided an eleven-page troubleshooting section which would appear to cover most of the problems that would be encountered.

The Model 150 *Bus Grabber* may be obtained from Paratronics, Inc. at 800 Charcot Avenue, San Jose, California 95131. I have found this an extremely useful diagnostic tool in the development of specialized systems using an S-100 Bus chassis. Both hardware and software developmental problems were uncovered and solved with a great reduction in time and energy that would have been spend without the aid of a logic analyzer. In particular, the availability of an S-100 Bus dedicated analyzer made the problems of signal selection and interconnection much easier.□

ROBOTS: Making Them Work

By Roger C. Garrett
Northeastern Regional Editor

Since the dawn of the Industrial Revolution, man has dreamed of finding a method of using machinery to handle the drudgery of work. Visions of mechanical men, electro-mechanical servants who will be able to handle mundane chores, has always been the ultimate quest.

With the growth of microcomputer technology, this dream or vision has possibilities. Yet there is more to robot development than providing a brain. The current state of robot design is not as advanced as many of us would like to hope or believe.

Therefore, to find out what is happening in the field of robotic research, I visited the Robot Research Group, at the University of Rhode Island at Kingston. This group is made up of several hard-working graduate students, and is headed by Professors J.R. Birk and R.B. Kelley. Their work is being funded by a grant from the National Science Foundation.

Professor Kelley explained that most people have the wrong idea about what robots really are. They see them either as the Hollywood stereotyped "robot" or the little mobile black boxes that scurry around the floor looking for electrical outlets to recharge their batteries. As Professor Kelley puts it, "The word 'robot' as it was originally defined, means *worker*. And the average worker does not scurry about the floor (except, possibly, for basketball players). A worker is usually in a relatively stationary position, performing some task."

This is certainly true of the research robot at URI. Indeed, it is virtually bolted to the floor, and while its workspace, that volume of space to which its arm has access, is limited to a mere few cubic feet, it is sufficient to provide it with the ability to perform many worthwhile tasks.

Their robot, called the Mark III, is mounted in a rack that provides it with three degrees of freedom. That means that it can move its arm vertically, horizontally, and forward and back. The arm itself has an additional three degrees of freedom, allowing it to extend from the supportive cage and to flex its wrist in two kinds of rotary motion. The actual hand of the robot can consist of a simple magnet for picking up metal objects, or a claw for grasping any type of small object. Photos 3 and 4 show the arm equipped with the magnetic hand. It was found that the claw hand often got in the way of the object and the computer had trouble seeing what it was doing.

Yes, the Mark III can see. In an earlier version it was connected to a standard vidicon type television camera. In the Mark III setup, a General Electric solid state camera provides sight to the robot. Working as an interrupt-driven input device the camera can provide a full field view of 128x128 pixels, (picture elements), in one thirtieth of a second. The computer then takes over to analyze the picture and determine what moves should be made by the robot arm, in order to accomplish its given task.

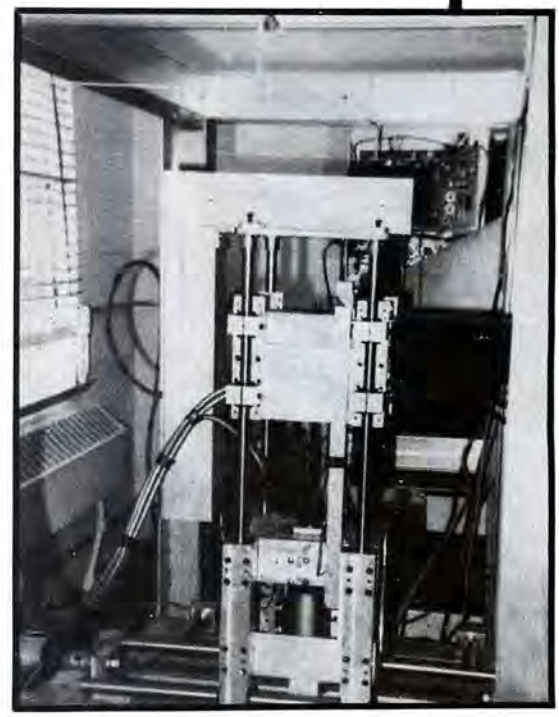


PHOTO 1 Side view of the rack-mounted Mark III.

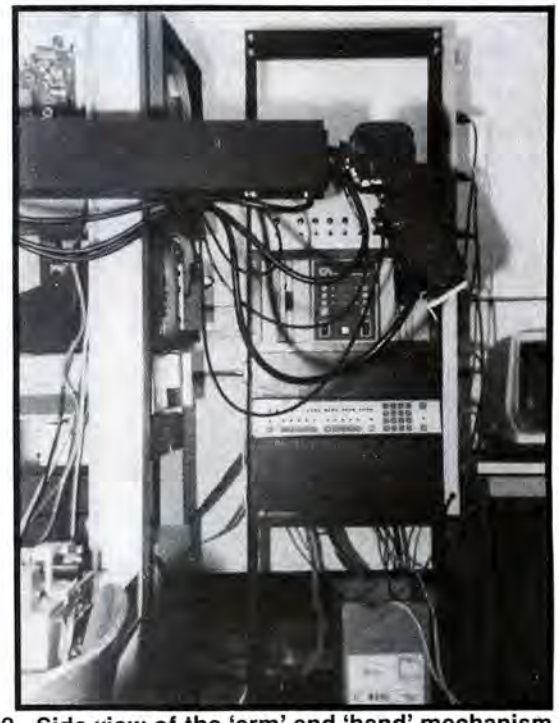


PHOTO 2 Side view of the 'arm' and 'hand' mechanism.

The task that it is currently working on, and which has the graduate students trying out new methods, is to retrieve a workpiece from a bin; then properly placing it on a conveyor belt or inserting it into a receptacle.

While that may sound like a fairly simple task, and indeed it is for any human being, it is actually a very intricate and complicated one for a computer. Take a look at a bin full of randomly oriented parts and try to determine exactly how your brain knows what constitutes an individual part. Your eye sees an array of points of light, with varying intensities. Somehow your brain, calling upon years of learned experience, analyzes that picture and comes up with a set of commands for your arms and hands to reach out, and pick up an individua piece. Is it a simple, straightforward method? If you think you fully understand it then try writing it down as a computer algorithm. You will soon realize the scope of this task. Yet that is what they are attempting to do at the Research Group.

Will they succeed? From what they have done so far, and they have published the results of their work to this point, it appears that they are on the right track. The researchers can already determine certain essential parameters about the field of view, such as identifying surfaces and corners. From that information, the orientation of the piece can be determined and eventually command the hand to pick it up. The next major hurdle is to be able to identify a single piece from among a random pile of similar workpieces.

The work is slow but rewarding. The eventual applications of a robot with this capability will more than pay back the time and expense that has, and will, go into this type of research. Eventually such robots will be able to replace human workers in environments which are dangerous, or where such use can result in increased productivity.

In the introduction to the report "General Methods to Enable Robots with Vision to Acquire, Orient, and Transport Workpieces: Third Report," Professor Birk writes: "Human labor is the dominant method used to load machines with workpieces which are supplied unoriented in bins . . . Humans cannot substantially change their performance at these jobs, therefore the use of humans cannot lead to significant improvement in productivity. These jobs do not enrich human life. People have increasingly higher aspirations for good jobs, thus labor is becoming harder to find and the cost of labor is increasing."

So there are high hopes for the future of robotics. But our current level of robotics technology has yet to produce a robot of the Star Wars genre. So those of us who are fascinated by the prospects of the future will wait, while researchers like Professors Birk and Kelley, and the graduate students at the University of Rhode Island, continue their work. Perhaps, just perhaps, someday we will each have a robot of our own doing the housework.□

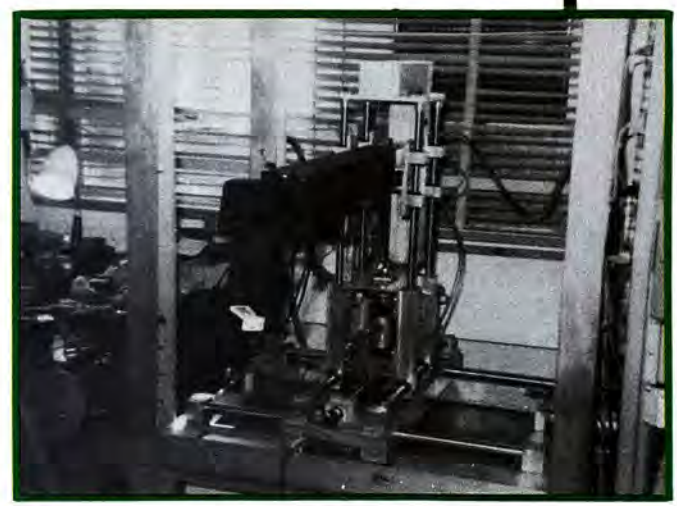


PHOTO 3 Front view of total arm and hand assembly.

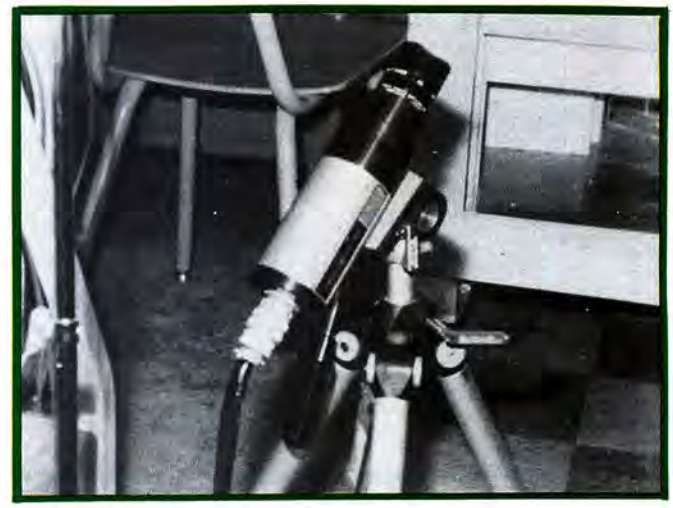


PHOTO 4 Eyes of the robot.

PHOTO 5 Setup for a test situation.

Robbie and Gronk

By Keith Paul

PHOTO 1

What good is it, or what can it do? These were the most frequently asked questions while 'Robbie' the robot was on display at Bell Canada's recent 'open house' held to celebrate the opening of their new 24-story Regional Headquarters building in Toronto. 'Robbit,' a tall conical shaped robot (Photo 1), and 'Gronk,' the shorter cylindrical machine (Photo 2), are the two robots which John Hughes and myself built over the past year.

I first became interested in robots while attending a communications trade show in Kansas City, Missouri, last year. I was not so much taken in by the technology required to make it work at the time, as I am exposed to that daily in my work, as I was the effect it had on the people that were confronted with a robot for the first time.

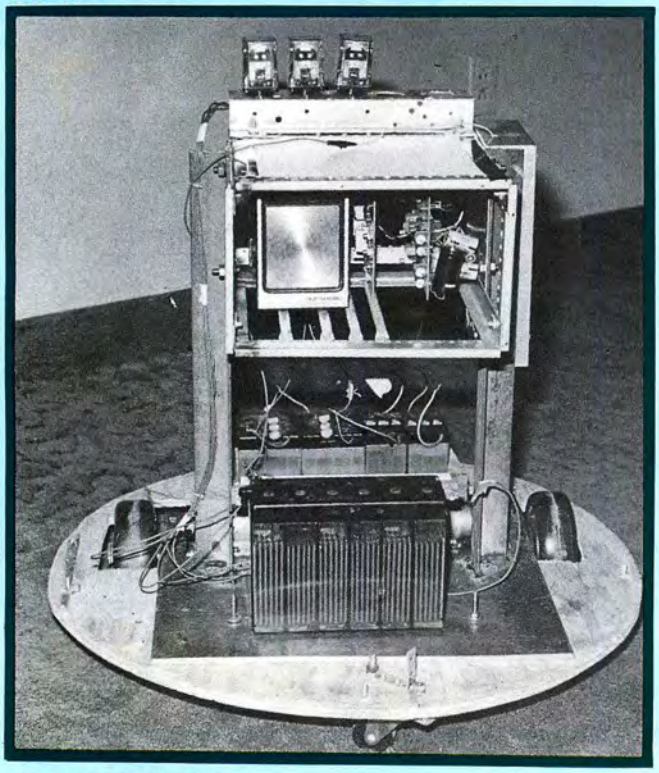
Robbie, the first attempt at building a robot, was constructed of . . . sheet metal, conical shaped to form the outer skin.

How does one feel talking to a piece of tin and electronic gadgetry resembling something less than a mechanical man, say, a shop type vacuum cleaner? Well, it soon became apparent to me that there are as many types of reactions as there are people.

However, three main reaction categories can be derived by observation. The first and most prevalent is surprise followed by bewilderment and in some cases fear.

Watching and noting these reactions with Robbie the robot, who weighed some 50 pounds and stood over 5 feet tall, caused the uneasy feeling that if it dropped a wheel off the edge of a walkway, it would topple over, crushing a small dog, child or Volkswagen. This led to the development of Gronk, the second robot, smaller and less threatening. Robbie, the first attempt at building a robot, was constructed of 1/32" x 5' sheet metal, conical shaped to form the outer skin. This mounted on a 1/2" plywood base 26" in diameter (this dimension happened to be that of my son's bicycle wheel used to draw the circular base). Two used car windshield wiper motors mounted vertically were its basic ingredient. These motors were energized by two 6-volt motorcycle batteries (6N2-2A) connected in series to give the 12 volts required to run them at full speed.

PHOTO 3



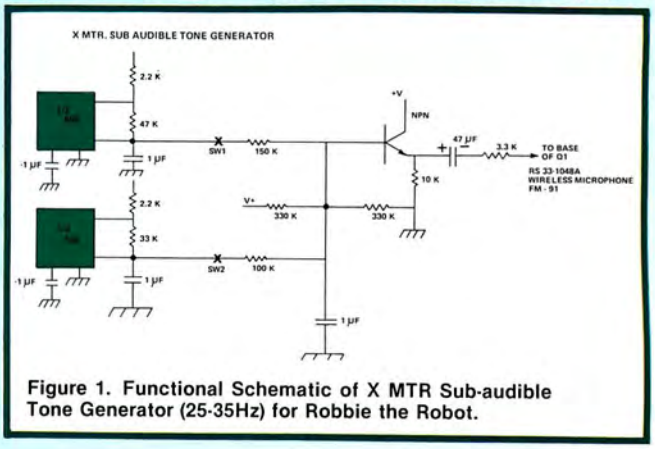


Figure 1. Functional Schematic of X MTR Sub-audible Tone Generator (25-35Hz) for Robbie the Robot.

Mobile Robots

Two speeds were provided by using the full 12 volts or tapping into the 6 volt connection, approximately 60/30 rpm respectively. Fast or slow speed was selected by a manual switch placed just below the back of his head at shoulder level, along with the power on/off switches.

The forward, right and left turn functions were accomplished by simply providing power to both, left or right wheels respectively. This was all under remote control using a hand-held RS, FM-91 Wireless Microphone and an RS AM/FM Pocket Portable Radio 12-609 mounted in the head of the robot. The head is a sphere, originally used as a speaker enclosure.

With the speaker removed and the receiver taking its place, along with the antenna sticking out the top of it, I now had remote controlled voice and functions.

The functions were operated by transmitting sub-audible tones 25 and 35 Hz which were push button energized and injected into the FM transmitter's amplifier stage (FIgure 1). At the receive end the sub-audible tones were picked off the receiver speaker (using the earphone jack, modified) and cabled to the base where they were amplified and used to lock two phase lock loops (567's). If and when they lock, it causes an output which controls a transistor driver which in turn operates two RS 12V DC DPDT relays. The 6 or 12 volts derived from the motorcycle batteries were passed over the form 'c' contacts fo the relays to the windings of the motors (Figure 2).

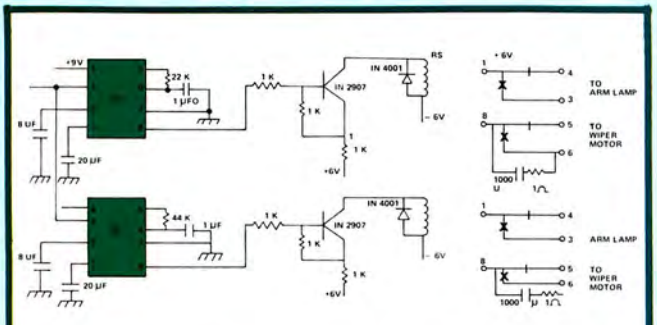


Figure 2. Functional Schematic of R CVR Sub-audible Tone Detector for Robbie the Robot.

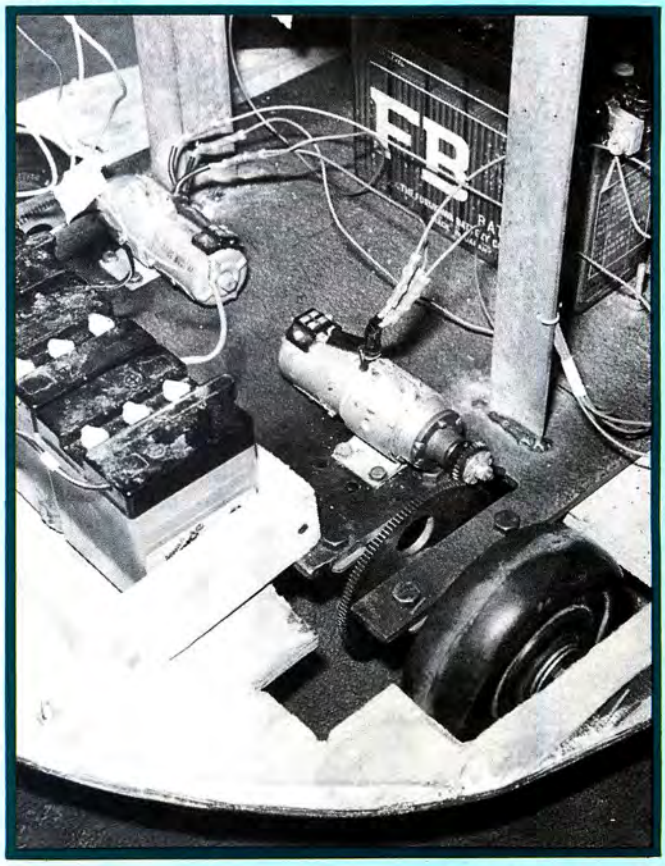
By pushing the buttons on the control box which injected the sub-audibles into the FM transmitter and/or speaking into the associated microphone you could control the forward direction of the robot and provide a voice.

Clearance lights, inserted in to the 2" exhaust flex tubing used for arms, which were subsequently bound with plastic electrical tape, were lighted over contacts of the right/left relays when the motors were energized. This provided some measure of awareness.

It was soon found that the FM transistor and receiver would fade and/or drift off frequency just enough to give unreliable operation. Also, the phase lock loops wouldn't, at times most of the electronic buffs know. Worse than that, it is characteristic for their output to become pseudo analog. This means that the output fluctuates rapidly between zero and one, leaving you in the "twilight zone." When this happens Robbie's behavior becomes erratic to say the least, and just maybe you have created a monster.

PHOTO 2

PHOTO 4



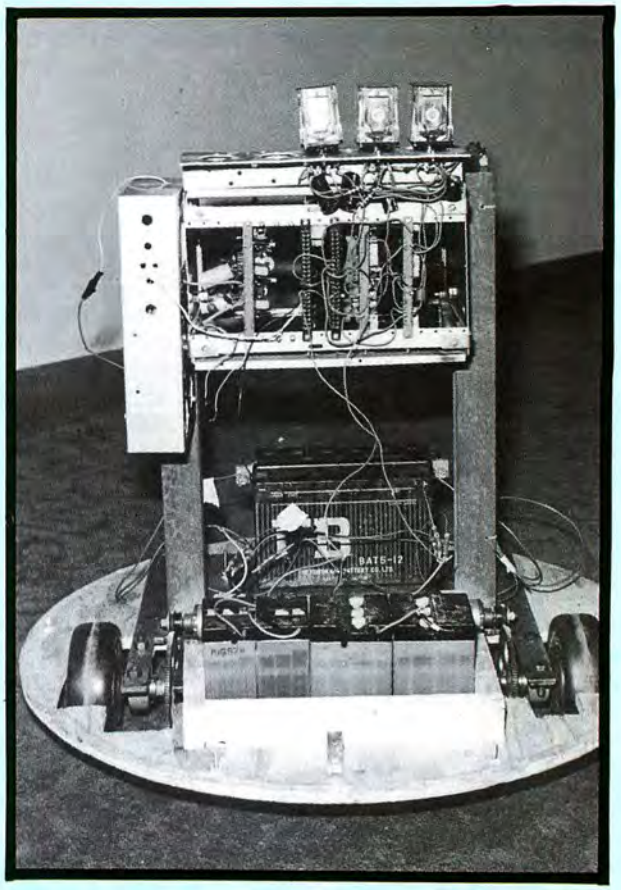


PHOTO 5

However, this first attempt was worthwhile as I soon found out what approach not to take. I should add, however, that for some fun with a semi-autonomous, (not designed that way), robot at a price almost anyone can afford, this approach has merit.

My second attempt at being creative resulted in a robot known as Gronk. Physically short and squatty, about 40" high and 22" in diameter, is more robotish in the popular sense.

Photo 2 is a general view of this robot as it appears. Practically speaking it resembles a large domed can of spray deodorant. Actually the outer skin is a 40 gallon (Imperial) hot water tank cover chopped down to 26". The machine is cylindrical, and weighs 50-60 pounds. The metal skin is covered with felt material, which gives it a warmer appearance plus color. This skin is removable for gaining access to the drive motors and electronic controls. Limited access to these components is also available through a covered port at the back.

Modular construction is used where possible, i.e. motor mounts, plug-in relays and circuit cards, etc. (Photo 3). The entire unit is powered by a number of 6 volt motorcycle batteries connected in series to provide up to 24 volts DC.

The robot's locomotion comes from two drive wheels (Photo 4). An idler is provided as a third wheel for balance. Direction is given by stopping one wheel and driving the other. The wheels are constructed of solid rubber 4½" in diameter and 1½" wide with a center steel core that has been forced onto a steel shaft. The shaft is geared and mounted between two self aligning pillow blocks. If both wheels are moved in the same direction, the robot travels forwards or backwards in a straight line. If the

wheels are moved in opposite directions, the robot executes a near perfect rotation about its vertical axis.

The precision of movement is limited principally by non-planer floors, wheel slippage, unequal wheel diameters, and the like.

The drive motors are Delco Appliance Motors #5070200, 12 volt DC reversable clutch driven geared units with electro-mechanical braking. I found these at an aircraft surplus parts store in Toronto. By the way these surplus stores, rather than the usual electronic surplus stores, have a better selection of good quality components at an almost affordable price. These motors were only eight dollars a piece; the wiper motors previously used were ten dollars each. I found matching shaft gears that gave me a wheel rotation of approximately 60 rpm. These were then assembled on a steel plate ¼" x 15" x 13" to form the arrangement as shown. Incidentally, don't use steel. Use aluminum and bolt things together if you don't have access to a heliarc welder. This cuts the weight down significantly (5-10 lbs.).

These motors are driven by 12V DC through contacts of RS 12V DC DPDT relays. I used these relays as they are "plug in" and have the contact current carrying capacity and operate voltage values that are required. This time, audible coded voice frequency tones were used at the transmit end, modulating a voltage controlled oscillator which provided a 16 kHz subcarrier center frequency. This subcarrier modulates a 100 mw crystal controlled transceiver which is currently in popular use, (Figure 3).

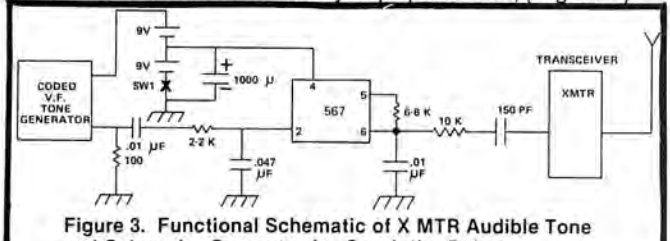


Figure 3. Functional Schematic of X MTR Audible Tone and Subcarrier Generator for Gronk the Robot.

A transceiver of a similar type is used to receive these coded voice frequency tones, which are put through a high pass filter and limiter. This 16 kHz subcarrier modulated by the coded voice frequency tones is demodulated using a 567 phase lock loop configured as an FM demodulator, leaving the VF tones only. Seven tones matrixed to provide 19 combinations give more than enough discrete outputs to drive the features that I wanted to include. All this is housed on a vertical stand welded to the metal base, (Figure 4).

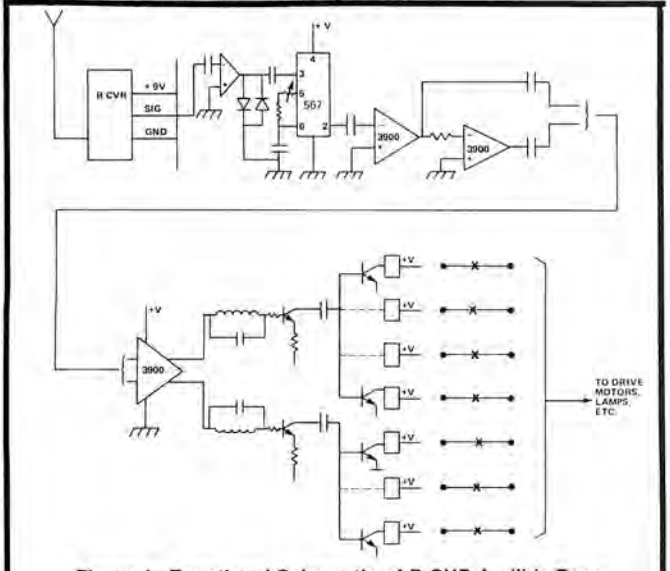


Figure 4. Functional Schematic of R CVR Audible Tone Demodulator and Detector for Gronk the Robot.

The housing consists of an aluminum "Bud" box 5" x 9" x 12" and a card cage 9½" x 9½" x 6" with 6 slots of which only 4 are currently being used. "Bud" box houses the transceiver and demodulator; the case cage holds the VF decoders, limiters and matrix relays. The physical arrangement of these electronic components helped considerably in shortening lead lengths and time in wiring. Standard 28-pin Vector 644 printed circuit board connectors were used in the card cage.

Using the audible coded voice frequency tones has significant advantages. First the response time is quicker, second a manual override or umbilical cord with a manual control box, using the same VF tones, is plugged into the circuit just ahead of the decoder. This has many advantages. If you lose the RF you can still get away with the umbilical cord. Admittedly not as attractive a proposition as the mystical RC approach; however, it doesn't leave you in the embarrassing position of non-operation during demonstrations. Murphy's law always applies in robotics. At least that's been my experience.

. . .however, it doesn't leave you in the embarrassing position of non-operation during demonstrations. Murphy's law always applies in robotics.

A soon to be installed microprocessor (8080) with maximum memory will give complete autonomy to Gronk.

This time the autonomy will be built in, not evolved as previously experienced with Robbie. The microprocessor will, under discrete instructions, control the functions of the robot (hopefully). The output interface will generate VF tones the same as those received by the manual override and from the demodulated RF, thereby simplifying the control process. Also, a sensor input (probably micro switch or other discrete input) will provide control input to the micro, whose instruction repertoire will include a series of instructions so that true stimulus/response action can be provided autonomously. Other laws of engineering similar to that of Murphy's will probably apply here.

The robot's voice is provided through a separate channel using the RS FM 91 Wireless Microphone to a RS 12-609 receiver. The obvious advantages and disadvantages are capitalized on, using separate channels.

At present Gronk has the following features:

1) Moves forward, reverse, left, right, counter clockwise and clockwise about its vertical axis.
2) Flashing collar lights (marquee style).
3) Modulated voice light (color organ principle).
4) Smoking ears. Pipes out the top.

Gronk's arms are made from dryer venting hose with rubber gloves stuffed with cotton for hands. These are not controlled as yet. The dome is a hemispherical bubble, obtained from a local plastics manufacturer.

Both Robbie and Gronk were built for entertainment purposes. Because of my background and interest, I found it challenging and interesting to put what little creative talent I have to work for entertainment purposes.

What good is he?!

What good is a new born baby?□

Since Keith has gotten your interest up, you might want to share some of your experiences with him, or possibly find out how Robbie and Gronk are doing. To contact Keith write to: Keith Paul, 112 Wareside Road, Etobicoke, Ontario, M9C 3B6, Canada.

—Editor

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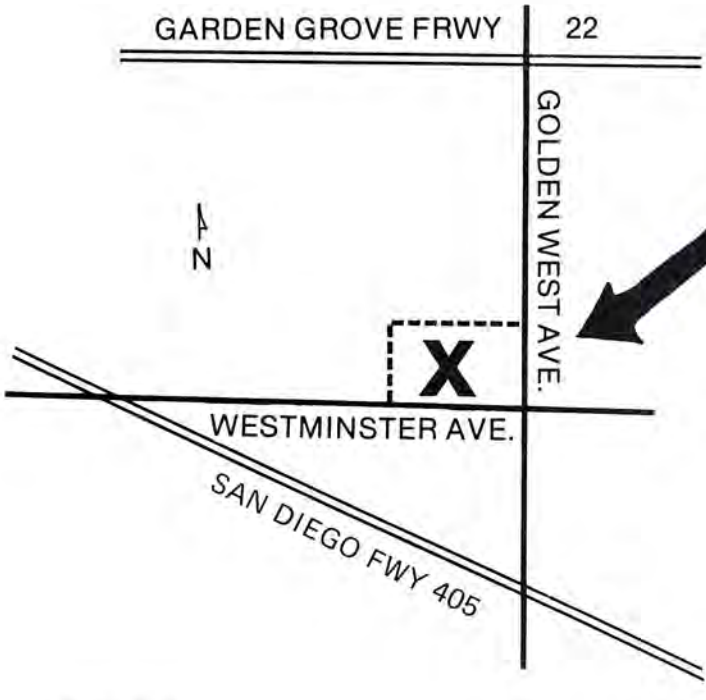

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CIRCLE INQUIRY NO. 79

The 8085 in Robot Design

By Frank Da Costa

One of the more unusual avenues open to the adventurous electronics experimenter is the building of robots. A natural outgrowth of the Home Computing Revolution, the field of robotics has virtually stepped out of the pages of science fiction and into the workshops of hobbyists.

Now, robotics is not exactly new. One need only marvel at some of the Audio-Animatronic creaions of the Disney staff to realize that much has been accomplished in terms of the mechanical configuration of robots.

What is recent, however, is the technical advance leading to the development of a complex control system for the robot, a brain. The Disney automatons are run by pretaped programs and are thus incapable of making decisions on any level. Computers can decide, but try to pack a roomful of equipment into a mobile robot body!

But we all know the story. The advent of the microprocessor combined complex decision-making and high-speed control with small size and low power. Microprocessors now pop up in everything from TV games to kitchen blenders. And somewhere, from the homes of countless frustrated roboticists, came a corporate sigh of relief. There was hope after all for the Robot.

But it's not as simple as all that just yet. There are considerations. First of all, a robot generally operates on a battery supply. Thus, there are limitations on how much memory, how much I/O — in short, how much power one may use. Second, size is still a factor. Six memory cards will not fit into a robot mouse. And third, the market abounds with microprocessors and support chips. 8080A, 6800, 6502, 2650, each have strengths and weaknesses, so which will you choose?

Here's where I show my bias, hopefully with due evidence. In terms of flexibility, instruction set, software availability, peripheral support, and even cost, the 8080A is still pretty much Number One. The Z-80 variation is a close second, but the cost is not yet down.

A straight 8080A design, though, has a few complications for the roboticist. First, the 8080A chip is not sufficient unto itself. To be of much worth, one needs the Intel 8224 clock chip and the 8228 Systems Controller, or their equivalents. That means extra wiring, but more significantly, stiffer power demands. Second, the 8080A requires + 12, + 5, and − 5 supplies. Granted the − 5 supply is miniscule, but it would be preferable if the roboticist could design around a single battery supply. (The poor soul who uses 1702 EPROMs also has a − 9 supply to contend with.) Other 8080A drawbacks, such as interrupt complexities, could be raised as well, but the first two are enough to give pause.

It was only a matter of time before Intel came through. Early in 1977 they first sampled their new 8085 microprocessor chip, which promises to be the microcomputer designer's dream.

The 8085 is basically an 8080A as far as logical architecture is concerned — the same registers, the same addressing capability, and essentially the same instruction set as before. But significant improvements have been instituted, improvements which may benefit the robot designer.

First, the 8085 contains its own clock and systems controller. Add a crystal and a simple reset network and you're ready to go, with all necessary waveforms internally generated. This means lower component count and easier hook-up. The 8085 uses roughly the same power as the 8080A, even though it performs the functions of the original three-chip set. Practically, this amounts to a savings of sixty-some-odd percent power usage.

Second, the 8085 is single-supply: + 5 volts. That is, your robot only needs a single-voltage battery supply, (no tapped batteries or power inverters). In this respect, Intel has sort of "caught up" with the single-supply philosophy of some other microprocessors, such as the 6800 and the Z-80.

But there's more. The 8085 has improved interrupt capability. The original 8080A required that an interrupt instruction be more or less "jammed onto" the data bus. The 8085, however, also has a set of four on-chip, prioritized vectored interrupts. Three of these are software-maskable, and all are certainly much easier to implement in a robotic system than the earlier approach.

Another helpful addition is a pair of pins for serial input and output data, labeled SID and SOD. Though these are more applicable to standard microcomputer systems, as basic interface to a TTY, CRT or cassette, roboticists can certainly find some uses for the extra I/O bit. And, after all, what if you'd like to program your robot serially, from a tape deck or even another microcomputer keyboard? The serial data port is an ideal way to "get into" the microprocessor without stealing word-space from an external I/O chip.

Now just a brief word about some new 8085-oriented peripheral ICs. Intel has also announced the first offering of two new 40-pin multi-function chips which, together with the 8085, form a basic minimum microcomputer system. One of the chips is the 8755, a combination of 1K bytes of EPROM and 16 software-programmable I/O lines. The other chip is the 8155, which consists of 256 bytes of static RAM, 22 programmable I/O lines, and a 14-bit programmable timer-counter.

So far, the cost of the 8755 EPROM-I/O bug is still up there. But the roboticists may want to consider using one or more inexpensive 8155 chips and go with an all-RAM system. Or if that seems amateurish, you can use the 8155 and add a standard EPROM, such as an 8708, as a non-volatile bootstrap or program monitor. The 8085 can handle all the earlier 8080A memories and peripherals.

Does this all sound a bit too rosy? Well, let's be honest; the 8085 does pose a few possible drawbacks. First, Intel made one semi-major design change from 8080A to 8085: they multiplexed the data lines with the lower eight address bits, and provided a strobe pin to separate the two. (The main reason for this was to free pins for additional features.) This means adding an 8-bit latch to extract address from data if you plan to use standard memories or peripheral devices. (The new 8755 and 8155 chips have a built-in address latch for this purpose.) For roboticists, it boils down either to an added component, or using the new chips. Take note, though. If your robot would require a fairly large memory, you'd probably need the extra latch anyway — or some sort of bus driver — to handle the added load. So only designers of smaller-scale robot systems need to give this dilemma much thought.

A second possible drawback involves the I/O portions of the 8155 and 8755. The ports associated with the new chips are essentially memory-mapped. Some may see this as an advantage, but it's all a matter of viewpoint.

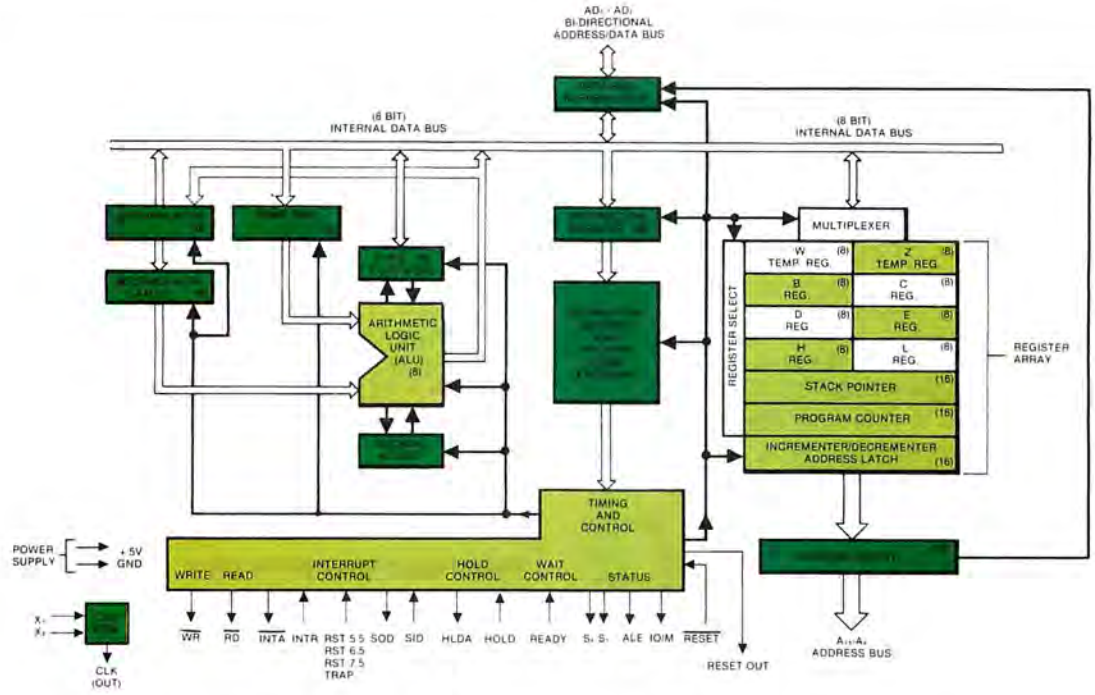


Figure 1. 8085 CPU Functional Block Diagram. Reprinted by courtesy of Intel Corporation, Copyright 1977.

Treating I/O as memory in either the 8080A or 8085 system means a reduction of available memory addressing, plus the additional tedium of using 3-byte memory-fetch instructions instead of standard 2-byte I/O instructions. But the 8085 addressable memory field, when decoded, is so vast anyway — 64K bytes — that this may be no problem. It largely depends on the orientation of the specific robot design — does it need lots of memory or lots of I/O?

A final difficulty at present is availability. The 8085s are relatively new and thus somewhat tough to get hold of. But, given time, they'll be covering the countryside. It might be wise to pick up on Intel's 8085 literature, and perhaps even to design your robot around the chip sight unseen. (The literature is quite lucid as to the capabilities and applications of the '85, even providing some sample schematics.) Chip cost even this early in the game is relatively low, but if you design now and buy later, chances are that you'll save some cash when they're more common.

Building a robot is not like building a hi-fi kit. Plenty of consideration, and perspiration, will be spent in the mechmechanical design and construction aspects. The simpler it is to design the Brain, the more time can be put into the integration of Brain and Body. This is not to say that the control circuitry is unimportant. But if the central processor is a bear to wire up, or a bear to supply power to, there'll be added frustration to the already-overworked roboticist.

The 8085 seems to be an ideal solution. It is sophisticated, yet simple. It has all of the logical power of the 8080A, plus some, and yet it is free of the major complications. In short, it is "state-of-the-art," and after all can we afford to have less than that in our robots?□

For those of you wishing further information on this article, or on the other two appearing in this issue, you can contact the author by writing to: Frank Da Costa, 10930 N.W. 14th Avenue, #A-13, Miami, FL 33167.

—Editor

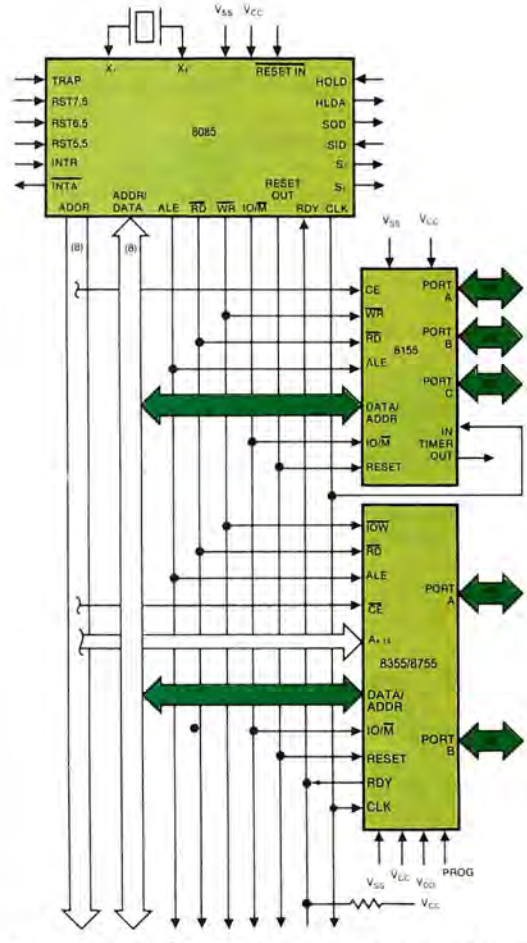


Figure 2. 8085 Minimum Component Count Microcomputer. Reprinted by courtesy of Intel Corporation, Copyright 1977.

A Vocal Interface for Your Robot

By Frank Da Costa

If I mention the word "robot," the phrase "the perfect mechanical servant" may come to mind. You envision the Man of the House asking his household robot to fetch his pipe and slippers, or Mother asking it to wash the dishes. And it complies promptly, for it is a robot — it does what it is told.

Unfortunately, the real life experimental robots of today are far from this ideal. You may tell one to wash the dishes, but it will stare back at you with a quizzical look on its faceplate. Reason: it doesn't know the language. "Punch my ASCII keyboard," it might say, "or feed me paper tape, or play me some serial data at a kilobaud or two. But don't talk to me — I can't hack it."

Now there's no real drawback to using a little remote-control box with switches and such, but you've got to have it with you all the time. The ideal situation is to enable your robot to interface to the human voice. Alas, though, speech recognition interface cards are still quite expensive. And robot-builders are notoriously short of large working capital.

Here is a relatively simple vocal interface which can be used to convey 4 or 8-bit chunks of data to your robot or personal computer system. It's a far cry from the English language, but it's affordable and quite effective.

The input to the Vocal Interface is a series of musical notes, hummed by the human operator. Now, if you can't carry a tune in a wheelbarrow, don't worry. All that is required is to know when a note is higher or lower in pitch than another one.

The operator hums a note — it doesn't matter what pitch it is. Then he hums a series of four (or eight) note, corresponding to bits in a byte of data. If he wishes a "1," he hums *higher* than his first note. If he wishes a "0," he hums *lower* than the first note. The system is self-synchronizing, so that the time length of each note is not critical, within a certain maximum limit. A second or two of silence in between each note allows the synchronization.

It's clear that the operator's musical abilities, (or disabilities), have little bearing on the circuit. He need not know what key he's in, or what musical intervals he's forming, or exactly how long he's humming. He just needs to hum higher or lower than his first note, as much higher or lower as he cares to hum.

The Vocal Interface described here is for four bits of data, and can be expanded to 8 bits with very little extra wiring. The 4-bit version is easier, since it's easier to keep track of five notes (a *first note* and four *bit notes*) than the nine notes of the 8-bit version.

The entire circuit is shown in Figure 1. Notice the outputs at the far right: a 4- or 8-bit parallel output port, and a data valid flag bit. The input is an inexpensive crystal lapel microphone.

The timing circuit, consisting of the 555 timer and the 74123 dual one-shot, presides over a simple frequency-latching arrangement. Input notes are converted to square waves by a 311 comparator, which are used to clock a pair of 7493 binary counters. Every 2/10 of a second, the resulting count is latched and the counters are cleared. Thus, the latches maintain a running record of input frequency. Since the highest count of the two 7493's is 255, the highest reliable input frequency is 255 divided by 2/10 sec, or 1275 Hz — which is about a D#, two octaves above middle C, a fairly high note for a female.

". . .feed me paper tape, or play me some serial data at a kilobaud or two. But don't talk to me — I can't hack it."

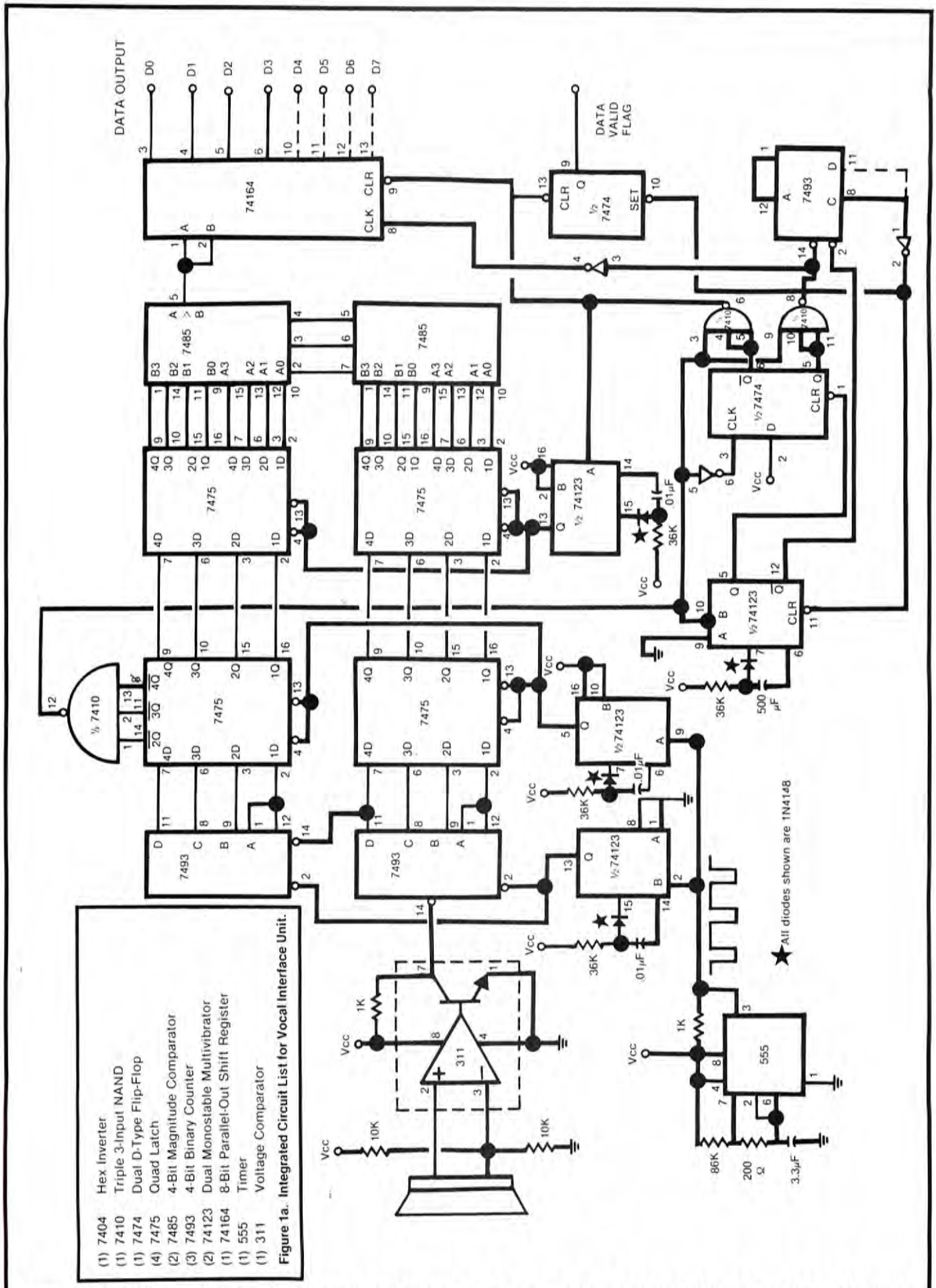
A 3-Input NAND gate is wired to function as an OR gate, to indicate whenever the frequency latch number exceeds 32, the equivalent of 160 Hz, about an E, two octaves below middle C. Thus, this gate is low in conditions of silence or low frequency ambient, but goes high during frequencies between 160 and 1275 Hz.

The gate triggers a one-shot (½ of a 74123), which indicates reception of the first note. If no second note is received within 5 seconds to re-trigger the one-shot, it will time out, returning the circuit to its passive ready state. In application, the operator cannot allow any longer than 5 seconds to elapse between each note, or else the circuit will reset. This feature prevents one-time bursts of frequency from being considered as data input.

One 7474 flip-flop is kept cleared by the one-shot until reception of a chain of notes. The first note leaves the flip-flop unaffected, until the note drops to silence, which clocks the flip-flop on the inverted edge of the 3-Input NAND gate output. The flip-flop is used to control the gating which separates the *first note* from the subsequent *bit notes*.

The NAND gate output is gated to one of two places, depending on the state of the flip-flop. On the first note, it is gated to latch the frequency word into a secondary pair of latches for temporary storage. (This becomes a reference number, the *first note.*) On the subsequent notes, the level is gated to clock an 8-bit shift register, which is being loaded by the output of a pair of 7485 magnitude comparators. The magnitude comparators compare the latched *first note* number with the new incoming *bit note,* and output a "1" if the new note-number is larger, and a "0" if not larger.

Let's review a bit. A basic frequency-counter circuit is always latching 2/10 sec samples of an input frequency.



(1) 7404 Hex Inverter
(1) 7410 Triple 3-Input NAND
(1) 7474 Dual D-Type Flip-Flop
(4) 7475 Quad Latch
(2) 7485 4-Bit Magnitude Comparator
(3) 7493 4-Bit Binary Counter
(2) 74123 Dual Monostable Multivibrator
(1) 74164 8-Bit Parallel-Out Shift Register
(1) 555 Timer
(1) 311 Voltage Comparator

Figure 1a. Integrated Circuit List for Vocal Interface Unit.

Figure 1. Vocal Interface Unit. Connections noted in dashed lines may be used to expand the basic unit from a 4-bit to an 8-bit capacity.

The *first note* received which exceeds a 160 Hz threshold is latched secondarily as a reference; every succeeding note is compared to it, which comparison determines the loading of an 8-bit shift register.

The clocking of the shift register also clocks a 7493 counter to keep track of the number of bits stored. When the 7493 reaches "4" or "8," its output line (either "C" or "D") is used to reset the one-shot and flip-flop in readiness for a new series of notes, and to set a Data Valid flip-flop. (The Data Valid flip-flop is cleared during reception of a new sequence of notes.)

The Vocal Interface Unit can convey data of all sorts to the robot. If the robot is based, say, on an 8080 microprocessor, the program could wait for reception of two 8-bit words from the Interface Unit and use these as the address to a subroutine which you desire to be performed.

It may take you a while to get the hang of using the Vocal Interface Unit, but here are a couple of guidelines to ease the pain.

1. Hum or "la" your first note at a comfortable pitch, one which is in the middle of your voice range, so that it won't be difficult to follow with higher or lower notes.
2. Hum or "la" your notes for around one second per note and allow a silent space of about one second between notes. Remember that 5 seconds is the limit for each note with its following moment of silence.

Robots, ideally, are meant to be largely autonomous in nature. Controlling a robot via a control box gives the impression of a puppet on a string. A vocally-controlled robot, though, gives the impression, and in part the reality, of a higher degree of autonomy. This Vocal Interface Unit can be used effectively to advance your personal robot project one step closer to this lofty goal.□

Computer Tutorial — Part III

Memories Remembered

By Roger Edelson, Hardware Editor

We will begin this month's discussion with a view of core memory principles and operation. Core memories store binary digits, without consuming electrical power, by virtue of the fact that they can be put into two different states of remanent magnetization. The two states of remanence are produced by applying magnetic fields of opposite polarity with sufficient strength to saturate, or nearly saturate, the material. Figure 1 shows these two possible states on the hysteresis loop of a typical square loop material. The fact that the store information will remain in the core with no application of power, once the initial state of remanence has been established, accounts for the non-volatility of this memory system. The reason for using a rectangular loop material can be seen from a glance at the typical B-H loop presented in Figure 1. Once a sufficient magnetic field (H_m) has been

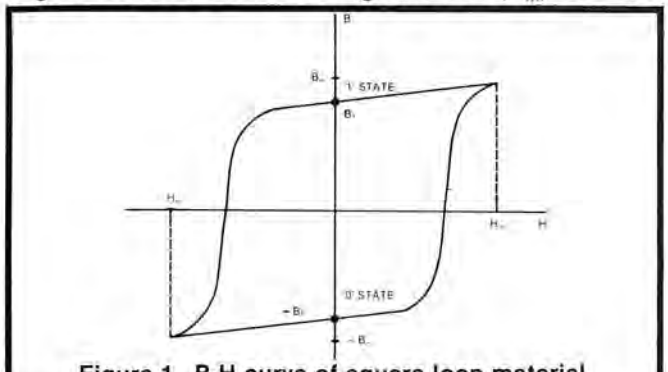


Figure 1. B-H curve of square loop material.

applied, the magnetic flux will attain a level of B_m. When the field is removed the flux level will move to B_1. Subsequent applications of a fieid H_m will move the flux level to B_m and back to B_1. The core will remain in this remanent flux state so long as a reverse field sufficient to switch the flux is not applied. When a field of $-H_m$ is applied, the flux will move of a level of $-B_m$ and move to $-B_0$ when the field is removed. If the core has a sense winding on it, a considerably larger voltage will be produced by the flux change from B_1 to $-B_0$ than will be produced when the flux changes from $-B_0$ to $-B_m$. It is this voltage that is sensed to indicate the presence of a stored "1." Because the core must be switched to the "0" state when being read, this type of memory is referred to as a *Destructive Read-Out (DRO)* memory. In a real life memory the voltage from the disturbed cores, (those with "0's") and the lead inductance produces a significant voltage as shown in Figure 2. As the "0" output

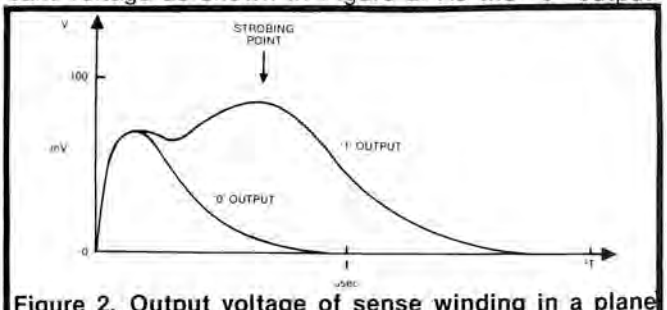


Figure 2. Output voltage of sense winding in a plane array of cores.

cores and the inductive voltages peak earlier in time than the "1" voltage, it is possible to obtain a greater "1" to "0" discrimination by evaluating the signal at some delayed time.

Besides their small size, one of the advantages of magnetic cores is the ability to easily wire up these devices to store large amounts of data. Figure 3 shows a

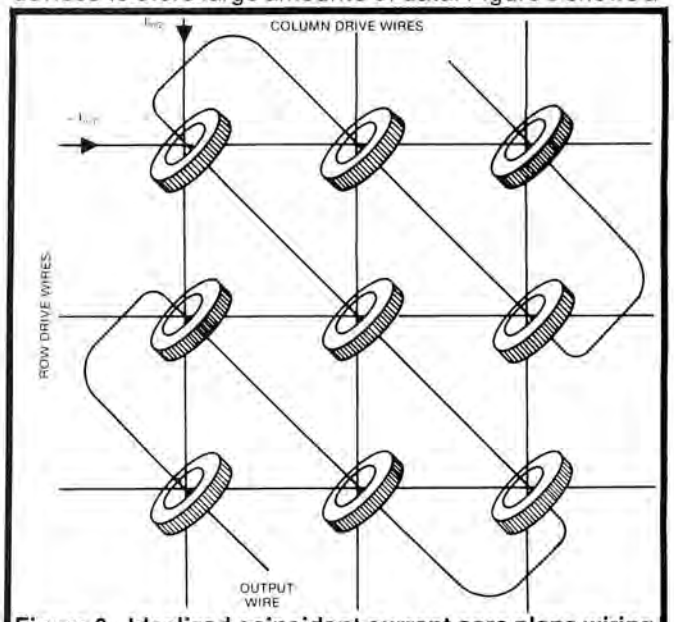


Figure 3. Idealized coincident current core plane wiring.

simplified diagram of the principle of a coincident current matrix store. In this design, a current (I_m/2) sufficient to produce half of the switching field, (H_m), is applied to the one each column and row drive wire. The core present at the intersection of the selected row and a "1" would be stored. The other cores, which are threaded by only one energized wire, receive only half this magnetic field strength and are substantially unaffected, although they are said to be disturbed. When reading, the currents are reduced and the output voltage is sensed by the additional output line threading each core. This figure shows a plane of only one digit of nine words. There will have to be as many planes as there are digits (bits) to be stored.

A more common method of wiring a coincident current drive matrix is shown in Figure 4, and the interconnection of these planes in a stack is shown in Figure 5. This wiring method uses a more complex pattern for the sense winding in order to affect a greater cancellation of the output of the disturbed cores and minimize the inductive coupling to the drive wires. When the planes are connected in this fashion, it is necessary for some trick to be used to keep from storing the same bit state in all the planes. The fourth winding called the digit, or inhibit, line performs this function. When information is being written into the cores a pulse of current equal, but opposite, to the half-write current in either the X or Y line is applied to very plane were a "0" is to be stored. This prevents the flux in the selected core from exceeding H_m/2, so the attempt to write a "1" is in-

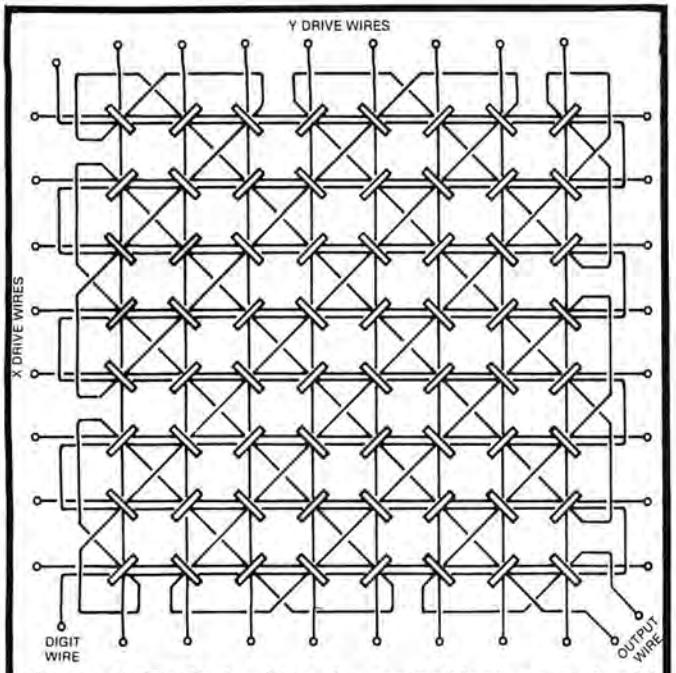


Figure 4. Typical wiring for coincident current with digit/inhibit.

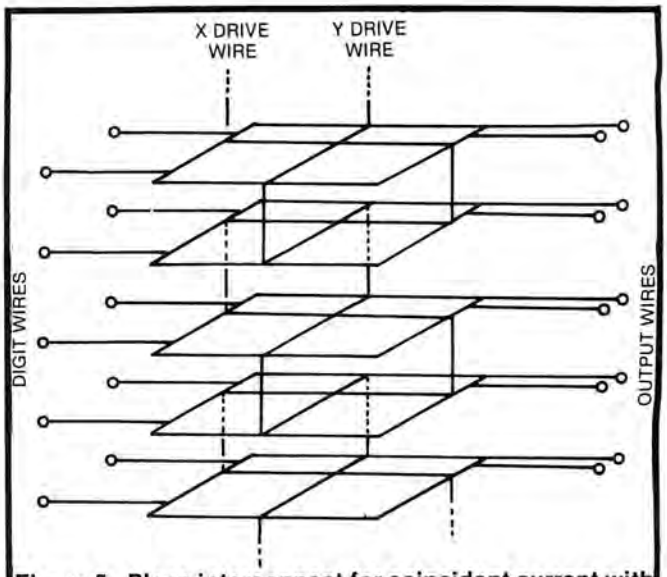


Figure 5. Plane interconnect for coincident current with digit plane.

hibited. Information in the other cores in the plane will be unaffected by the digit pulse as it will reduce the drive experienced by cores on the selected row and column to zero, while the remainder of the cores will receive a half-current pulse in the opposite direction.

More complex systems can be constructed using additional cores for eitehr selection or storage. Systems using the additional cores for switching exhibit less dependence on the coincident current tolerances at the cost of higher drive currents and more complexity. A two-core per-bit system using both cores for storage allows faster operation at the cost of increased complexity. In the main, almost all practical core storage systems are constructed using only one core per bit; as faster speeds were required, they were achieved by decreasing the core size.

The possible practical arrangements of the cores and core planes is reasonably limited and well known. The success or failure of the storage system really depends on the design of the drive, selection, and sense circuitry. It is in this arena that the ingenuity of the circuit designer plays an important role. The selection circuits developed are too numerous to catalog here, but some of the problems that must be solved are: 1) high drive currents, 2) variation of drive requirements with temperature, 3) large back voltages from the effect of the core inductances, and 4) fast switching speeds. In almost all new core stores the function of the sense circuitry is provided by an integrated circuit sense amplifier. The advent of these devices has greatly simplified the life of the core memory designer.

Another way to use information stored in the square loop of a magnetic material is to move this magnetized medium under a sensing head. With this method the change in flux, which produces a voltage output, is accomplished by physically moving the magnetized area rather than switching the flux. For this reason the stored flux remains at the same state as it was prior to the read operation and the device is a *non-destructive readout memory.* This is the principle behind the magnetic recording on all moving memories: tape, disks, or drums. The magnetic medium selected is based on cost, system access time, and complexity considerations. Tape storage usually has the longest average latency time with disks falling between the tape drives and the magnetic drums. Complexity and cost appears to be the inverse of the latency time. Drums saw great utility in military aircraft systems because of their ruggedness and high storage capacity, coupled with a reasonable access time. The more common approaches for the micro/minicomputer field are tapes (either cassette or 7/9 track) and floppy disks.

No matter which type of store is selected, it is necessary to select a recording method for providing information as to the data being stored. Nine of the most popular recording methods are shown in Figure 6. Any method

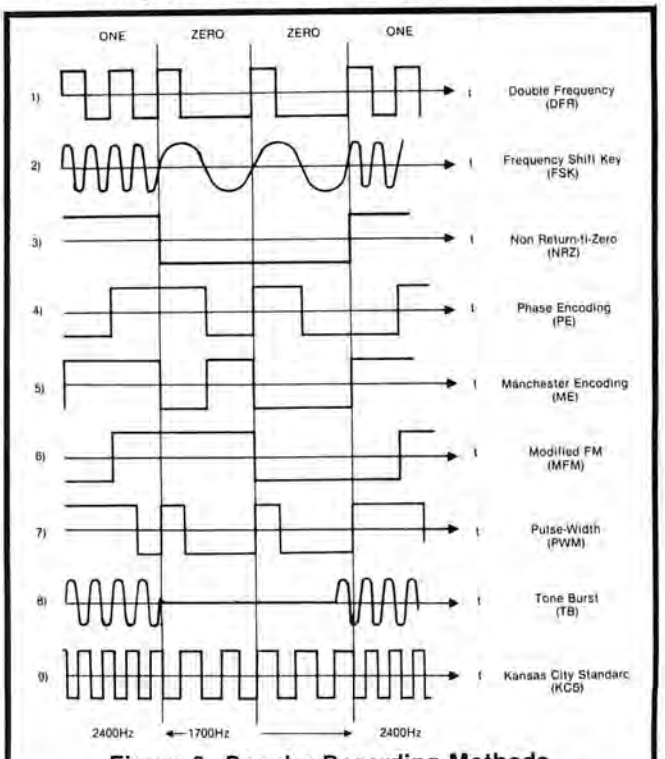


Figure 6. Popular Recording Methods.

could be used with any recording medium, but in practice certain systems work better with a particular storage device. Cassette recorders, because of their lack of speed, accuracy and the use of less than optimum tapes, require a method which overcomes these limitations. The Kansas City Standard has achieved wide usage with some systems which employ better drives, using either Manchester or a modification of the NRZ system. Most drum systems used wither NRZ or Manchester, with

Manchester being the preferred system because of its self-clocking nature. The 7/9 track tape drives use NRZ for the lower character densities, and use Phase Encoding or Manchester at higher character densities. Floppy disks can use either NRZ or the Phase Encoding Manchester method. Let's look at each system briefly:

Double-Frequency Recording (DFR), is an inherently self-clocking scheme which is immune to wow and flutter. It does not have the magnetic drift and bit packing problem of NRZ, but requires a high bandwidth.

Frequency Shift Keying (FSK) is used in most modems, (Modulator-Demodulator), data transmission systems because of its noise and amplitude rejection. However, it is very speed dependent. It does provide a very good tape drop-out rejection because of the number of flux reversals per bit. This system is found mostly in high quality instrumentation recorders.

Basically, you can have it IBM's way and be compatible with the rest of the world, or you can use your own format for increased storage but be restricted to your own system, or similar systems.

Non-Return-To-Zero (NRZ) system, and its brother NRZI (NRZ Inverted), have the current in the head in one direction for a "1" and in the opposite direction for a "0." In NRZI the magnetic flux is reversed at every "1" and is left unchanged for "0's." This system requires an extremely high bandwidth, it must go down to almost dc because of the lack of flux changes for "0's." It also suffers from bit packing problems due to the shift of the "1" output peak, depending on the previous information, and from baseline shift. It is not self-clocking and must have an additional clock track and read/write head.

Phase Encoding (PE) and *Manchester Encoding (ME)* are two manifestations of the bi-phase recording technique. In an effort to overcome the limitations of NRZ a scheme was developed in which there was at least one flux change for each recorded bit, be it a "1" or a "0." The state of the information determines the direction of the flux change and hence the polarity of the output signal. In PE the flux change occurs in the middle of each bit cell and in ME it occurs at the beginning of each bit cell. Both methods are inherently self-clocking; there is at least one flux change per bit with ME being easier to generate and decode. The required frequency of bi-phase recording is equal to twice the bit rate.

Modified FM (MFM) was developed in an attempt to reduce maximum of two flux reversals per bit of bi-phase. This system requires the addition of a data encoding device to place the flux reversals according to the following rules: A 1 is defined as a flux reversal at the center of the bit cell and a 0 as a flux reversal at the beginning of the cell *except* when preceded by a 1. In that case no flux reversal occurs during the bit cell for a zero. The system is self-clocking and can pack twice the data that can be recorded with bi-phase. A companion scheme M²FM (Modified Modified FM) uses a more complicated encoding algorithm in order to reduce bit shifting problems.

Pulse Width Modulation (PWM) is a scheme to adjust the width of the recorded flux to correspond to a 1 or a 0. It is a patented process which is self-clocking and noise and amplitude-level tolerant.

Tone Burst (TB) is an extremely simple scheme for recording data; a 1 is recorded as a burst of tone while a 0 is blank. It is not self-clocking and is extremely sensitive to amplitude level and noise.

Kansas City Standard (KCS) is the most popular system in the home computer market. It is a mixture of Manchester, FSK and Tone Burst. An 8-cycle burst of 2400 Hz is used to record a 1 and 4-cycle burst of 1200 Hz is a 0. A phased-lock loop can be used to produce a 4800 Hz clock from the recorded data. This system is reasonably independent of speed variations, and relatively insensitive to amplitude variations and noise. The use of multiple flux reversals per bit limits the packing density, but reduces the possibility of tape drop outs.

With the exception of bubble-memories, (which will be covered much later), this completes the survey of magnetic storage techniques. We have not covered the detailed design and formating specifications of the tapes or disks because they are somewhat device or controller dependent. Basically you can have it IBM's way and be compatible with the rest of the world, or you can use your own format for increased storage but be restricted to your own system, or similar systems.

Next month we will take a look at the semiconductor memory field, with coverage of RAMs, ROMs, PROMs and EPROMs. □

NEW PRODUCTS

TEMPOS Multi-User/Multi-Tasking Operating System

An upgraded version of the time-shared 8080 operating system, TEMPOS (Timed Environment Multi-Partitioned Operating System), the package is designed to be transportable among systems through a new System Generation Routine.

TEMPOS has many features of systems normally found only on much larger machines, for example, batch processing simultaneously with interactive use, foreground/background processing, true multi-tasking (many different jobs/processes executing simultaneously) and an extensive array of programs.

For further information and prices contact Administrative Systems, Inc. (A.S.I.), 222 Milwaukee, Suite 102, Denver, CO 80206, (303) 321-2473.

CIRCLE INQUIRY NO. 202

ANS 68 AND 74 COBOL COURSE

Info 3 has just published *COBOL Training,* an introductory course on COBOL programming. The course teaches the essentials of the COBOL programming language to beginning programmers as well as to those who wish to add COBOL to their knowledge of programming languages. Instruction begins with the basics of encoding principles, and covers input characteristics, program hierarchy, and all four COBOL divisions. Both ANS 68 and ANS 74 COBOL are covered,a s well as basic disk and tape concepts. Students encode arithmetic, logic and control statements, and are able to successfully write complete COBOL programs.

The course materials consist of audio-cassette instructional tapes and an accompanying workbook. The workbook is heavily oriented toward the response sections, which make up half of all visual materials. The price is $295.00. A free "GOT Chart" showing the course Goals, Objectives and Tasks, is available from the publisher. Further information is available from Info 3, 21241 Ventura Blvd., Suite 193, Woodland Hills, CA 91364, (800) 423-5205 or (213) 999-5753, Larry Vermillion.

CIRCLE INQUIRY NO. 166

HARD COPY HARDWARE

COMPUTER TEXTile announces the availability of its line of high quality hard copy hardware. Computer Textile sells reconditioned QUME and DIABLO daisy wheel printing terminals. These terminals feature 30 CPS printers, 96 character keyboards with 10 key numeric pad, ASCII coded, RS 232 interface. Also 256 character buffer, user's and service manual, with full graphics capability packaged in a beautiful beige cabinet with black and chrome wheeled pedestal.

Options include 45 CPS and 55 CPS mechanisms for some QUMEs, other encodings, pin feed platen, tractor forms feeder and service contracts. Each terminal comes with a limited 30 day warranty. Quantities are limited. Prices from under $2,000. Also available are reconditioned ADM-1's, modems and paper tape punch/readers.

For complete information contact COMPUTER TEXTile, 10960 Wilshire Blvd., Suite 1504, Los Angeles, CA 90024, (213) 477-2196.

CIRCLE INQUIRY NO. 167

UNIVERSAL MICROCOMPUTER SYSTEM

Microsystem 10/10, consisting of two complete, ready-to-use, tape-based 8K systems, including two high speed CRTs, two keyboards, two dual tape units, operating software and manuals, is priced at $5850, a savings of $1850 over the cost of two separate systems. This price includes choice of 8080, 6800 or Z-80 microprocessor for each half of the system.

Microsystem 30/30 provides two complete standard 8" floppy disk based systems, each with 16K bytes of RAM. Other configurations combine 32K QUICKRUN™ tape-based coresident systems with standard or mini floppy 16K systems, all at a substantial savings over two separate systems.

For additional information contact Futuredata Computer Corp., 11205 So. La Cienega Blvd., Los Angeles, CA 90045, (213) 641-7700, Bob Schaaf.

CIRCLE INQUIRY NO. 163

REFERENCE BOOK C207

Microprocessor Interface Techniques — From Keyboard to Floppy Disk, by Austin Lesea and Rodnay Zaks: One or multi-card implementations of microprocessor interfaces are becoming obsolete; one-chip LSI components plus software may now be used. Interfacing has been simplified by the new LSI components and related software techniques to the point where an electronics background is no longer required to build a system.

The book takes you through the complete assembly of a microprocessor system: *assembling a CPU; Input-Output techniques: interfacing to a keyboard, LED, teletype, printer, floppy disk, CRT, cassette-tape; industrial interfacing; analog-digital techniques; communications; bussing and standards, incuding S100, IEEE488, CAMAC.* A complete case-study is presented for a multi-channel communication system and a chapter is dedicated to trouble-shooting techniques. Actual interconnects are presented for a number of microprocessors, and, in particular the 8080 and the 6800.

Completing the discussion is a chapter on analog to digital conversion techniques and products allowing many "real world" systems to be designed and interfaced. For more information contact Sybex, 2161 Shattuck Ave., Berkeley, CA 94704, (415) 848-8233.

CIRCLE INQUIRY NO. 164

CREATIVE COMPUTING CATALOG

A new 16-page catalog from Creative Computing describes books, magazines, games, T-shirts, and other items of interest to the seasoned computer professional as well as the beginning novice.

Nearly one hundred fascinating, but hard-to-find, books are offered on topics from problem solving to programming and from computer games to computer literacy. Both British and American magazines are described as well as board games, posters, prints and T-shirts.

Earlier editinos of Creative Computing's catalog have been described by others as "The Whole Earth Catalog of computing," and "the most comprehensive guide to educational and home computing available under one cover." The price is right — FREE. Get yours today.

For your copy or more information contact Creative Computing, Attn: Kim, P.O. Box 789-M, Morristown, NJ 07960.

CIRCLE INQUIRY NO. 165

GREAT MAY PROMOTION

Spectacular savings on top quality data processing items offered form ANSCO during the entire month of May, 1978.

Items to be featured on the "Great May Promotion" will include floppy diskettes, data modules, disk cartridges, computer tape, computer ribbons, data processing labels, digital cassettes and a wide variety of systems for convenient storage and retrieval of valuable media. A special focus will be on IBM, DEC, NCR and Honeywell systems.

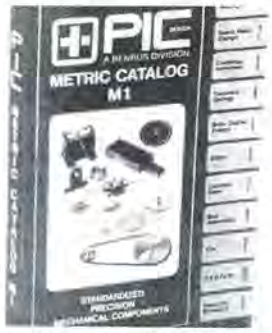
Literature and catalogs will be sent to all regular ANSCO customers in April. Special "Great May Promotion" catalogs will be forwarded to interested readers upon request. All orders will be shipped freight-free within 48 hours of notification, and satisfaction is always guaranteed.

For additional information call American National Supply Corporation toll-free at (800) 421-1270, or in California call collect (213) 532-7780, or write to ANSCO, P.O. Box 2259, Gardena, CA 90247.

CIRCLE INQUIRY NO. 160

METRIC PRECISION COMPONENTS CATALOG

The most comprehensive compilation of metric system standardized precision mechanical components and assemblies has been produced by PIC Design Division of Wells-Benrus Corporation. All items presented in the catalog are available for delivery immediately from stock.



The new 208-page edition contains over 25,000 components, covering 24 different product categories. Also included in the catalog are working prints, technical reference data tables, gear data, metric terms and formulas,

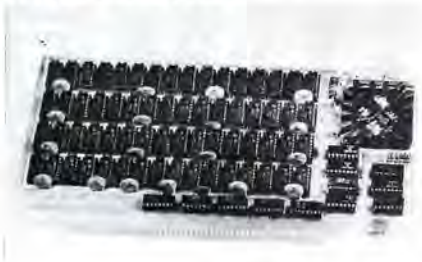
and many other valuable design/production aids.

For a free copy of the new Metric Catalog, write PIC Design Div., Wells-Benrus Corp., P.O. Box 335, Benrus Center, Ridgefield, CT 06877, Attn: Catalog Department.

CIRCLE INQUIRY NO. 161

LOGOS 8KX 8K STATIC MEMORY BOARD

Advanced Computer Products, Inc. has a new 250 ns. version of the highly received LOGOS 8K Memory board.



The LOGOS 8KZ features complete buffering on all data and address lines, memory protect down to 256 bytes, addressing on any 1K boundary, phantom line, battery back-up, and mil quality PC board with silk screen and solder mask.

The LOGOS 8KZ is available immediately at $149.95 Kit and $199.95 assembled and tested. The LOGOS 8K is now priced at $125.95 Kit and $179.95 tested and assembled. In quantity 4 units or more, reduce to $117.00 Kit.

For more information contact, Advanced Computer Products, P.O. Box 17329, Irvine, CA 92713, 1310 "B" E. Edinger, Santa Ana, CA 92705, (714) 558-8813.

CIRCLE INQUIRY NO. 174

AUTOMATIC RANGE DPM

When signals exceed the set range of IMC's 300 Series DPM, it can automatically shift to the next higher or lower range, protecting the instrument and eliminating external switching.

The Automatic Range DPM offers four ranges: ±200mV, ±2V, ±20V, and ±200V. Decimal points are positioned automatically and step up/down response time is 360ms. All control logic, shift registers, timing circuits, precision resistors, and analog switches are located on a single PCB inserted in the DPM during manufacture.

Price of the Auto Range Model starts at $124 in 1 to 9 quantities. Delivery is stock to 4 weeks. Contact Dr. Otto Fest, International Microtronics Corporation, 4016 E. Tennessee St., Tucson, AZ 85714, (602) 748-7900.

CIRCLE INQUIRY NO. 175

Low-Cost 64K ROM

A 65,536-bit read only memory, requiring 200mW of power typically, is being produced in large quantities at low cost by Rockwell International.

Organized in an 8192x8-bit configuration, the Z88XX ROM further extends Rockwell's family to give users low system cost, while providing twice as much storage as the company's A66XX ROM. Applications for the 64K device include cash registers, computer terminals, medical equipment, accounting machines, games, equipment controllers, and telephones.

Most existing PPS systems can easily interchange the A88X with A66- A52- and A05-ROMs by inserting the device directly into the socket. The bus interface electronics included on the chip eliminates board changing.

Prototypes of the A88XX ROM are available four weeks after ROM code approval. The device sells for $12 in large volume, and $37.65 in lots of 100.

For more information contact Rockwell International, Electronics Devices Div., 3310 Miraloma Ave., Anaheim, CA 92803, (714) 632-2321, Leo Scanlon, (213) 386-8776, Pattie Atteberry.

CIRCLE INQUIRY NO. 176

NEW BYTE SHOPPER AVAILABLE

The new 1978 edition of the Byte Shopper, a unique guide to the fascinating world of personal computing, is now available through MicroAge. The guide features complete descriptions of microcomputer systems that meet the needs of hobbyists and businessmen.

Recognizing the need for education, the Byte Shopper is also an introductory text to personal computing, providing a glossary of computer buzz words, and grapic visualizations of how microcomputers work and where they can be useful.

The Byte Shopper is presented in a clear and informative style, and includes over 125 detailed photographs of equipment from more than 120 manufacturers. Price of the Byte Shopper is $3.95. For more information contact MicroAge, 1425 W. 12th Pl., #101, Tempe, AZ 85281.

CIRCLE INQUIRY NO. 168

CHART AND GRAPH PAPERS

The CODEX Book Company has a new catalog on their complete line of chart and graph papers. The 36-page, 4-color catalog shows almost all of the standard grid patterns in either actual or one fifth size. Comprehensive listings provide additional details such as minor and major accent intervals, number of divisions, and/or log cycles, scale factors, and time remarks.

The well-organized catalog features details on square-grid sheets, time-cycle sheets, data sheets, semi- and full-logarithmic sheets, rectangular-grid sheets, metric sheets, miscellaneous sheets (such as polar coordinate, circular percentage, separated sections, sound, Gantt chart, probability chart, hyperbolic, trilinear, isometric, Schlink, geochemical, vapor-pressure, nomographs, and others) as well as custom sheets.

Illustrations show the standard grid patterns in their basic color of olive-green, orange, blue, and/or black. There are three standard sheet sizes (8½x11", 11'16½", and 17x22") and two types of standard paper stock (light and heavy).

The catalog itself is in the new metric DIN A4 size of 210x297mm (8¼ x 11'1⁄16"). It is available free on request to CODEX Book Company, 74 Broadway, Norwood, MA 02062, (617) 769-1050.

CIRCLE INQUIRY NO. 171

COMPUTER MAGAZINE FOR THE SMALL BUSINESSMAN

SBC Magazine—Small Business Computers is a new magazine for the businessman who is considering the purchase of a small computer. It's written in non-technical language and emphasizes the benefits of computerization.

SBC Magazine is a monthly publication. For more information contact SBC Magazine, 33 Watchung Plaza, Montclair, NJ 07042, (201) 746-4266, Gail Music.

CIRCLE INQUIRY NO. 172

TCE-124 TALKING CLOCK

The TCE-124 Talking Clock, with a distinctive male voice, automatically logs the time of day on their recording systems in either English, German or Arabic.

The vocabulary of the talking clock is produced electronically by a custom speech synthesis micro-controller. When used with either voice or device activated recorders, the TCE-124 inserts a clear distinct verbal announcement immediately following each recorded message.

Although developed to be used with Omnicron recorders, the Talking Clock can be used in other applications where continuous or on-demand time announcements are required. In many instances the TCE-14 will replace the expensive time code generators previously required to electronically record the time on magnetic tape, and eliminates the need for special decoding equipment on playback.

For further information, contact Omnicron Electronics, P.O. Box 623, Putnam, CT 06260, (203) 928-0377.

CIRCLE INQUIRY NO. 173

BROCHURE AVAILABLE ON LOW REFLECTANCE ELECTRONIC READOUT FILTERS

SGL Homalite, a division of SGL Industries, has available a two-page brochure on its Homalite™ low-reflectance display screens and filters for use with light emitting diodes, in digital panel meters, planar displays, liquid crystal displays, gas discharge, and CRT's.

The new brochure explains how to improve display readability as well as resolution in order to reduce gross distortion, and edge and surface defocusing. Also featured are technical charts and guidelines to the selection of the proper Homalite low-glare filter to insure optimum readability.

The new brochure is free and available by contacting the SGL Homalite plant, 11 Brookside Dr., Wilmington, DE 19804, (302) 652-3686.

CIRCLE INQUIRY NO. 169

DISK BROCHURE

A new eight-page brochure from Pertec Computer Corporation's Pertec Division, Chatsworth, California, describes the "most versatile, compact, and reliable disk drives in the world." The brochure highlights the major features of four flexible disk drives currently being marketed by the division, largely on an OEM basis — FD410, FD5X0, FD511A, and FD514.

The new brochure is available from PCC Pertec, 9600 Irondale Ave., Chatsworth, CA 91311.

CIRCLE INQUIRY NO. 170

VERSATILE P.O.S. FINANCIAL TRANSACTION TERMINAL

A retail point-of-sale terminal that will prompt the user through a variety of financial transactions is available from Concord Computing Corporation of Bedford, Massachusetts.

The Concord 800 Modular Transaction Terminal is a compact, microprocessor controlled unit that enables a merchant to perform up to 16 separate financial transactions at point-of-sale. Extensive prompting leads the user, either a store clerk or a customer, through the steps involved with transactions such as credit and debit card authorization, deposits, withdrawals, transfers and check verification. System logic helps prevent errors, and minimal training is required.

The Concord 800 Modular Transaction Terminal is priced from $850 without printer and from $2000 with printer, depending upon quantity and options selected.

For more information contact Concord Computing Corporation, Irwin Adams, Vice President, 7 Alfred Circle, Bedford, MA 01730, (617) 275-1730.

CIRCLE INQUIRY NO. 162

Facsimile Systems, and DESNET™ Universal Network Capability

Anticipating accelerated use of electronic devices for urgent business communications, Graphic Sciences, Inc., a subsidiary of Burroughs Corporation, announces its dex 1100 series and dex 5100 facsimile systems and a universal facsimile networking capability known as DEXNET. Employing the new dex 1100 and dex 5100 systems, as well as other dex models and even other brands of equipment, a DEXNET facsimile network enables business people to communicate a full page of printed, handwritten, pictorial or other graphic information worldwide at speeds ranging down to as little as 20 seconds.

Because of its speed, accuracy, and easy operation, facsimile equipment has become a major carrier of "electronic mail." It converts text, photographs and graphics into electronic impulses which are transmitted over telephone lines. At the receiving end, the impulses are converted back into a facsimile of the original.

The basic model in the dex 1100 series is priced at $2,500. The basic dex 5100 high-speed digital system may be purchased for $12,000. Rental rates are available, and include maintenance. For more information contact Graphic Sciences, Inc., Corporate Dr., Commerce Park, Danbury, CT 06810, (203) 792-6000, James Hawkins.

CIRCLE INQUIRY NO. 182

"FEDRON" Reconditioner for Offset Blankets

FEDRON Reconditioner that removes ink and glaze from offset rollers and blankets and works equally well cleaning computer printers and other office print and copying equipment, is available from Federal Mining & Manufacturing Company.

FEDRON Reconditioner is recommended when such trouble signs as stripping, loss of sharpness, uneven ink distribution, excess ink usage, too many waste sheets, color changing, and roller and blanket life is shortened, appear.

FEDRON evaporates quickly, leaving no residue, and it contains no toxic ingredients. For more information contact Federal Mining & Manufacturing Co., 288 12th Ave., Roselle, NJ 07203.

CIRCLE INQUIRY NO. 183

Accounts Receivable

The MCBS accounts receivable operating system for anesthesiologists is a cost-effective accounts receivable system when combined with a microcomputer system. The system operates on a dual North Star Micro Disk system. Patient data such as name, address, insurance, SSN, etc. may be added, changed, deleted, sorted, and listed.

Operation of the system is easy to learn, and little operator training is required. The user is prompted for all commands and error messages are provided throughout. 32K of RAM and a 120 column printer are required. A CRT with 64 columns or more is recommended. The capacity is typically 5 to 5 months.

The standard version is $300.00. For more information contact MCBS, 560 Bellwood Dr., Santa Clara, CA 95050, (408) 253-3240.

CIRCLE INQUIRY NO. 177

Low Noise, Low Offset Voltage

Designated the OP-05CP Instrumentation Operational Amplifier, this device, in its tough epoxy, mini-dip package, is well suited for high-speed loading in printed wiring boards using automated insertion equipment.

With gain of at least 120,000 and noise 0.65 microvolt p-p or below, between 0.1 and 10 Hz, the OP-05CP excels as a high performance, instrumentation grade operational amplifier. Suitable applications include strain gauge and thermocouple bridges, high gain active filters, buffers, integrators, as well as sample and hold circuits.

Due to its 8-lead DIP configuration, the device is a direct replacement for 725s, 108As, and unnulled 741s. Thus, the OP-05CP provides an instantaneous performance improvement without redesign. Untrimmed offset voltage is typically 0.3 microvolt at a 25°C ambient with drift of no more than 1.2 microvolts/°C over an ambient temperature range of 0°-70°C.

In stock at distributors now, the OP-05CP is priced at $2.75 in quantities of 100 to 999. For more information, contact Precision Monolithics, Inc., 1500 Space Park Dr., Santa Clara, CA 95050, (408) 246-9222, Ext. 183.

CIRCLE INQUIRY NO. 178

Softbyte

SOFTBYTE is developing a line of applications software to put the home computer to work. The first offering is a Federal Income Tax program which is written in BASIC and runs in 8K bytes of memory. It is interactive with the user and prints warnings if the user attempts to violate IRS rules.

Versions presently available are as follows:

	FIT	FITAB
Source listing	$14.75	$19.60
North Star Mini-Disk	18.60	22.60
Mits 3.2/Tarbell Cassette	16.60	20.60
Pet Cassette	16.60	
Radio Shack TRS80 Cassette	16.60	

All versions come with user instructions. For more information contact Softbyte, 315 Dominion Dr., Newport News, VA 23602.

CIRCLE INQUIRY NO. 179

Direct Mail Campaigns

The new service is from Urban Decision Systems. It is a breakthrough for marketing researchers, sales penetration analysts and direct mail campaign planners because it lets them target mailings to Zip areas that have the specific demographic profile they want to reach.

The new service provides updated population, household, income and consumer expenditure estimates for all metropolitan Zip areas with city delivery service. Also available is the full range of 1970 Census information by Zip Code.

Prices vary with the number of Zip areas requested, with single reports starting at under $25. For further information contact Urban Decision Systems, 21 Charles St., P.O. Box 551, Westport, CT 06889, (203) 226-736.

CIRCLE INQUIRY NO. 180

The TDS-M68 Microcomputer System

The TDS-M68 Microcomputer Training and Development System brings to the educator, industrial trainer and personal computer enthusiast an integrated system that comes complete with microcomputer (packaged in an attache style case), self teaching lab manual, textbook and an experimenter's lab package. This is a complete and self-contained system that brings together in one package all the ingredients needed to put together "hands-on" training courses aimed at those who need to develop a working capability with microcomputers.

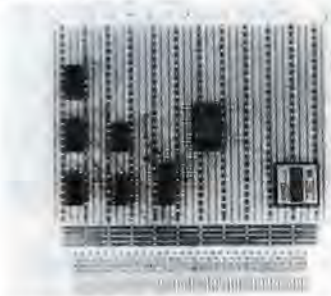
The capabilities and features of the system make it an attractive low cost development system for many applications. Six general purpose I/O ports (utilizing the SWTPC bus configuration) accept a line of interface boards that includes parallel and serial I/O ports, a cassette interface, an interrupt timer, a calculator module, an EPROM programmer, etc.

All items are available separately or as a total package. A descriptive brochure is available upon request. For more information contact Technical Devices Ltd., 1138 Main St., Winnipeg, Manitoba, Canada R2W 3F3, (204) 589-4803.

CIRCLE INQUIRY NO. 181

Z80 Arithmetic Processing Unit

Fully compatible witht he Zilog Z80 MCB, this High-Speed Arithmeic Processing Unit Board (HAPUB) provides the hardware necessary to accomplish arithmetic, trigonometric, inverse trigonometric, logarithmic, exponential, and square root functions.



HAPUB simplifies software and allows the Z80 to perform other operations while accomplishing these functions. Also featured are fixed-point integer, single and double precision (16/32 bit), and floating-point, single precision (32 bit), operation with bidirectional conversion capability from one to the other.

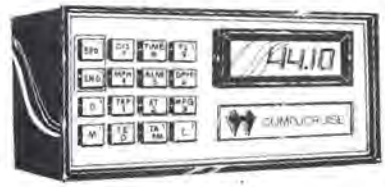
The HAPUB is compatible with the Zilog Z80 card cage and 8-bit bidirectional data bus through which all data and command transfers occur.

The HAPUB is available from stock and priced at $749 in small quantities. For additional information contact Bill Chidester, Signal Laboratories, Inc., 202 N. State College Blvd., Orange, CA 92668, (714) 634-1533.

CIRCLE INQUIRY NO. 189

Compucruise

It is the need to save fuel that sparked the development of Compucruise. It accomplishes its objective in a number of ways. First, its cruise control smooths driving, resulting in reduced fuel consumption.



Second, by providing a feedback to tell the drive when he is being fuel efficient, it helps eliminate gas wasting habits. Third, it shows the driver which brand and grade of gasoline is most economical in his vehicle. (Tests show in excess of 11% difference in fuel consumption between major brands of gasoline.) Fourth, it monitors engine efficiency, letting the driver know when tuneup work is needed.

For more information and prices contact Donald King, Vice President, Zemco, Inc., 1136 Saranap Ave., Suite L, Walnut Creek, CA 94595, (415) 935-4960.

CIRCLE INQUIRY NO. 184

New Tool Wraps Without Pre-Stripping

A newly developed wrapped-wire tool from Vector Electronic Company, makes gas-tight interconnections with standard Tefzel insulated wire without time-consuming measuring, cutting and stripping. Polyurethane-Nylon wire only could previously be slit and wrapped. "Daisy-chain" temrinations require about 5 seconds per post — less time that it normally takes to strip insulation from conventional wrapped-wire.

A second generation product, the P184 Slit-n-Wrap™ bit uses 28-gauge silver-plated copper wire with five mil thick Tefzel insulation fed from a spool on the tool's shaft. A hardened cutting edge, adjacent to the wrapping bit, slits the insulation longitudinally along the wire at the point a wrap is to be made.

The P184-4T1 is priced at $89.00, P184-4T battery-powered pencil type unit at $80.00, and P184 manual tool at $29.50. For more information contact Vector Electronic Co., Inc., 12460 Gladstone Ave., Sylmar, CA 91342, (213) 365-9661.

CIRCLE INQUIRY NO. 188

Security Systems

A new central control access and maximum security system that electronically operates an entire network of security, access and environmental equipment — and simultaneously specifies the appropriate action required for any alarm condition or environmental system malfunction — is available from Cardkey Systems, a division of Greer Hydraulics, Inc.

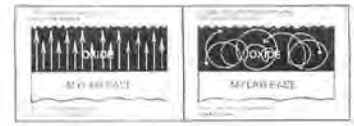
Called PASS™ — Programmed Access/Security System — the sophisticated computer-based Cardkey system not only displays in detail the correction action to be taken for everything from unauthorized intrusion to an interruption in the air conditioning — but also assures that such action is taken.

For further information contact Cardkey Systems, a div. of Greer Hydraulics, Inc., 20339 Nordhoff St., Chatsworth, CA 91311.

CIRCLE INQUIRY NO. 191

Universal Computer Tape

Wabash Tape Corporation introduces the computer industry's first universally adaptable tape for high density or low density drives, at high or low speeds, in hot or cold environments, under varied relative humidity ratings.



This premium tape is priced at about $18 per reel for a 2400 foot reel. It may be ordered from Wabash distributors. For more information contact Carl Holder, Vice President, Product Management, Wabash Tape Corp., Wabash Tower, Huntley, IL 60142, (312) 669-5181.

CIRCLE INQUIRY NO. 187

30% Price Cut on Control Data Band Printers

The Printer Sales Company now offers any model of the new Control Data band printer plug-compatible with the DEC-20 general purpose computer for approximately 30% less than prices charged by the computer manufacturer.

Control Data band printers are available with printing speeds of 300, 600, or 900 lines per minute in the standard 64-character set. Optional 48, 96, or 128-character sets with corresponding increases or decreases in printing speeds can be selected by changing the print band. Code marks on the band automatically adjust the printer for the character set selected.

For more information and prices contact The Printer Sales Company, 2684 Dawson Ave., Long Beach, CA 90806.

CIRCLE INQUIRY NO. 185

Dialog Voice-Command System

Voice command of devices is the main feature of a new hospital system for immobilized patients. The Dialog 117 System allows voice control of bed motors, lights, typewriter, telephone, calculator, computer games, tele-

vision, radio, and nurse call, by speaking commands through a microphone.

The system, which has a vocabulary of 99 words, uses an electronic display for verification of commands, prompting, and other communication with the user. The 117 system operates by converting sound waves into electrical signals which in turn are amplified and converted into a digital form that can be understood by the system's word processor.

The system trains itself to the user's manner of speaking. It is possible for it to respond to foreign accents and dialects. Probably the most dramatic performance of the system occurs when the typewriter begins typing a letter as the user spells each word.

For more information contact Marketing Dept., Dialog Systems, Inc., 32 Locust St., Belmont, MA 02178, (617) 489-2830.

CIRCLE INQUIRY NO. 186

CDA Opens Associate Membership to Computer Lessors

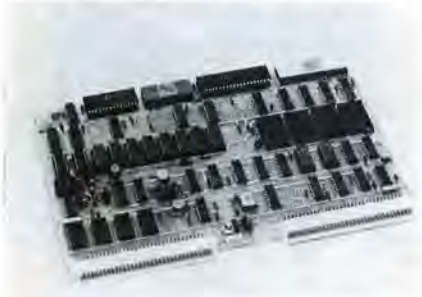
The Computer Dealers Association has voted to grant Associate Membership in CDA to computer leasing firms and their representatives. CDA in an international trade association which promotes the advantages of used computers.

Applications for Associate Membership in CDA may be obtained by writing Marvin Lurie, Executive Director, Computer Dealers Association, 6650 Northwest Highway, Chicago, IL 60631.

CIRCLE INQUIRY NO. 190

Two Micro-Based Boards Meet Standard Specifications in Europe

The Z80-MCB/E and Z80-MDC/E are new versions of Zilog's single board computer and memory/disk controller board, both designed to meet standard European specifications.



Featuring the same basic capabilities as their domestic counterparts, the "E" version boards meet the standard specifications commonly adopted in West Germany, the United Kingdom, France and Switzerland.

Single unit price for the Z80-MCB/E is $595; the Z80-MDC/E is $895. Prices for U.S., F.O.B. Cupertino, CA. For detailed specifications and applications information contact Vince Schlezes at Zilog, 10460 Bubb Rd., Cupertino, CA 95014, (408) 446-4666.

CIRCLE INQUIRY NO. 200

EPROM Programmer

Model 7608, a low cost self-contained programmer for type 2704 and 2708 EPROMs, has program entry via panel keyboard and true hexadecimal display of addresses and data.

Model 7608 may also be used to copy master EPROMs and to read preprogrammed EPROMs, and an accessory emulator unit permits loading from an external keyboard or computer. Type 2716, 2K x 8 EPROMs may be programmed in two passes using the optional adapter board. Extensive editing capabilities in Model 7608 allow insertion and deletion of data with resequencing prior to programming.

For more information contact SMR Electronics, 3 Haven Rd., Medfield, MA 02052, (617) 359-7697, S. Rudnick.

CIRCLE INQUIRY NO. 199

North Star Now Offers Terminal for Horizon

A 24-line by 80 character CRT display terminal is available for use with the Horizon computer.

The CRT terminal, manufactured under agreement with Soroc Technology, can be connected to the Horizon with I/O port at baud rates up to 9600 baud. The terminal is the Soroc model IQ 120 and has an addressable cursor, upper and lower case ASCII character set and a numeric key pad. A 90-day limited warranty is honored by Soroc.

Price for Soroc IQ 120 Terminal (assembled only) is $995. Delivery is stock to 90 days. For more information contact a local North Star dealer or North Star Computers, Inc., 2547 Ninth St., Berkeley, CA 94710, (415) 549-0858.

CIRCLE INQUIRY NO. 198

"Soundfoil"

Soundfoil is a light-weight, vibration damping material. It combines constraining, damping and pressure sensitive adhesive in a single peel-and-stick sheet.

The metallic paintable finish makes Soundfoil ideally suited for applications requiring an attractive appearance. It has excellent resistance to abrasion, water, chemicals, and is suitable for outdoor use. The easy to apply material is available in die-cut shapes.

A product sheet, with complete specifications and performance characteristics is available from The Soundcoat Co., 175 Pearl St., Brooklyn, NY 11201.

CIRCLE INQUIRY NO. 193

Small Quantity Custom Look Imprinted Business/Office Forms

A complete line of crash imprinted custom look business and office forms with name, address and other information, is being offered the home hobbyist and small business computer user.

Available in quantities as low as 250, the forms feature both carbon and NCR carbonless sets. The line includes statements, invoices, checks, quick mailers, labels, continuous envelopes, etc. Prices include delivery. Special logo, artwork, and custom form design service is also available.

Write for our 24-page catalog. Master Charge and VISA/BankAmericard accepted. Printcraft Systems, Inc., 11-17 Beach St., New York, NY 10013, (212) 966-0001.

CIRCLE INQUIRY NO. 197

Optical Reader

Chatsworth Data Corporation has available a microprocessor in their Series 4000 Readers. The microprocessor, an Intel 8085, will be used exclusively to handle different communicatin protocols. This will enable users to upgrade their system with only a minor program change, ensuring longer useful life for the hardware. Communication protocol with any new computer system will merely mean a change of program EPROM which can be a field modification.

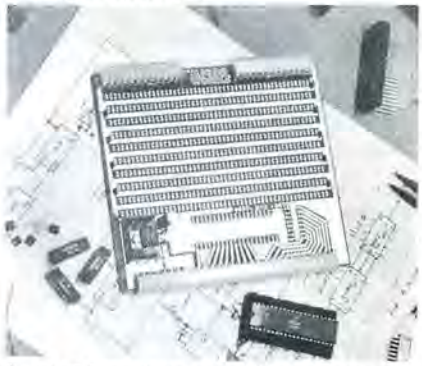
The microprocessor can be added to all three models of the 4000 Series; 4200, one-sided timing mark reader; 4300 reads timing mark and standard tab cards; and a Model 4800 which can read data on both sides of a card.

The Model 4200 with microprocessor will sell at $2,795, the Model 4300 at $3,395 and the 4800 at $4,450. Delivery is 45 days ARO. For more information contact Chatsworth Data Corp., 20710 Lassen St., Chatsworth, CA 91311, (213) 341-9200.

CIRCLE INQUIRY NO. 195

UIO Universal I/O Board

The Micro Works Universal I/O Board is just the thing for custom interfaces. The board has space for a 40-pin wire-wrap socket into which you may plug any of Motorola's 40 or 24-pin interface chips; the data and control lines are connected to the appropriate edge connector pins. All other bus connections ar ebrought out to a 16-pin socket pad.



A +5 volt regulator and all Molex connectors are provided; regulated +5 and ground are bused among the locations for up to 35 14-pin ICs. Price is $24.95. For more information contact The Micro Works, P.O. Box 1110, Del Mark, CA 92014, (714) 756-2687.

CIRCLE INQUIRY NO. 194

New Aluminum Power Makes Superior Ceramic Coatings

Metco 101SF is a new flame spray powder from Metco, Inc., that produces dense, smooth as-sprayed ceramic coatings. These coatings have excellent resistance to wear by abrasive grains, hard surfaces, cavitation, and particle erosion. They provide erosion protection for parts such as butterfly valves in oil and water hydraulic systems. They are recommended for slush pump piston rods, water turbine buckets, and dump valve plugs and seats. They are also recommended for the textile industry, to pro-

tect against abrasive wear from fast moving threads.

Metco 101SF is a superfine grade of alumina compounded with 2 percent titanium dioxide to toughen the grain. Coatings have an as-sprayed surface texture ranging from 100 to 150 microinches aa. They can be brushed or tumbled to 13-17, ground to 10, and lapped to 2-4 microinches aa. Dielectric strengths are high, providing excellent electrical insulation.

For more information or descriptive brochure, contact Metco, Inc., Dept. 959, 1101 Prospect Ave., Westbury, NY 11590.

CIRCLE INQUIRY NO. 192

Communications Floppy Disk System

The Comm-Stor II is a communications floppy disk system used in the following applications: Intelligence for Terminals; Time Share Enhancements; Unattended Data Transfer; Remote Batch Operation; Interactive Data Entry; Data Logging; Distributed Processing; ASCII/IBM 3740 Conversion.

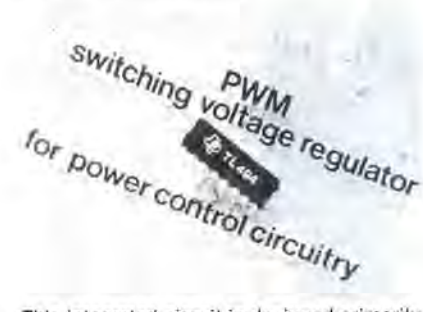
The system uses IBM 3740 compatible diskettes and interfaces with all RS-232 communications devices. Comm-Stor II is microprocessor-based, enabling the user to store and retrieve files by file source.

Comm-Stor II offers the following new features: Variable Length Files; Merging Files; and Buffering. For more information contact Sykes Datatronics, Inc., 375 Orchard St., Rochester, NY 14606, (716) 458-8000.

CIRCLE INQUIRY NO. 196

Pulse-Width-Modulation Switching Voltage Regulator

A new pulse-width-modulation (PWM) switching voltage regulator IC is available from Texas Instruments Inc. The TL494 has on a single chip all the functions required for pulse-width-modulation control circuits.



This integrated circuit is designed primarily for power supply control. It has an on-chip five-volt regulator, error amplifier, current limit amplifier, adjustable oscillator, dead time control comparator, pulse-steering flip-flop and output control circuitry.

The TL494, offered in 16-pin plastic and ceramic dual-in-line packages, is characterized for 0°-70° temperature range operation. Prices in 100-piece quantities for the TL494CN (plastic DIP) is $2.88 and $3.31 for the TL494CJ (ceramic DIP). For more information contact Texas Instruments Inc., Inq. Ans. Serv., P.O. Box 5012, M/S 308 (Attn: TL494), Dallas, TX 75222.

CIRCLE INQUIRY NO. 207

Data Communications Handbook

A guide to the basic concepts of data communications is provided in the *Data Communications Handbook* by Alan J. Weissberger, available for $3.50 from Signetics.

In response to the rapidly growing demand for data communications linkning a central computer with remote users, the 176-page book aids program managers and design engineers in achieving a basic understanding of the elements of a data communication system.

The handbook describes in detail applications examples such as source data entry and collection, remote batch processing and remote job entry, information retrieval and conversational time sharing.

Extensive definitions and explanations are featured such as types of channels, digital vs. analog transmission, asynchronous vs. synchronous transmission and modulation techniques, binary serial interfaces and protocols.

Also included is a detailed description fo two Signetics' products tailored specifically for the data communications designer: the 2651 Programmable Communications Interface (PCI) and the 2652 Multi-Protocol Communications Controller (MPCC).

The handbook incorporates six appendices on such topics as "Maximum Capacity of a Channel" and "Integrated Circuits for Data Communications Equipment;" a list of places to write for specifications; and a data communications reference guide.

For a copy of Data Communications Handbook send your request with a check or money order to Signetics, P.O. Box 9052, 811 E. Arques Ave., Sunnyvale, CA 94086, (408) 739-7700.

CIRCLE INQUIRY NO. 208

Application Source Data

Improved industrial productivity through expanded application of source data automation (SDA) is the subject of a new report, designed to give industrial management an overview of this relatively unexploited segment of the automation industry.

Defining SDA as "a means of collecting data about an event in computer-readable form at the point and time of the event's occurrence," the report acknowledges emerging SDA users in the service sector, but puts primary emphasis on potential applications in manufacturing, materials handling and storage and work force management. It includes capsule descriptions of six typical SDA applicatinos as well as a discussion of factors currently inhibiting the accelerated growth of SDA.

The compact management briefing, "Increasing Industrial Productivity through Source Data Automation," is available from Reymont Associates, 29D Reymont Ave., Rye, NY 10580, $3.00 per copy.

CIRCLE INQUIRY NO. 201

Anti-Static Kit Work Station

Micro Electronic Systems, Inc. has combined three of their standard Anti Static products to make up an inexpensive kit that will enable firms to enter into the Static Safe Work Stations without the expene of going all the way with work benches, chairs, etc.

Called the Anti Static Kit, it includes an 18"

x 24" Conductive Work Mat, an 8' Conductive Ground Strap and a 4' Conductive Plastic Wrist Strap. This kit will essentially cover the basic needs of many that are beginning to assemble MOS products into their own product.

Order Model ASK, P/N 1420. Price is $17.50 in single quantities. Distributor stocked throughout the U.S. For more information contact Micro Electronic Systems, Inc., 8 Kevin Dr., Danbury, CT 06810, (203) 746-2525.

CIRCLE INQUIRY NO. 206

Circuit Evaluators

The POWERACE line includes three power breadboards, Models 101, 102, and 103. All three models offer 256-5 tie-point terminals and 16-25 tie-point buses, fused powr supply and ground plane.

All Models feature industry accepted Super-Strip SS-2's and will accept all DIP sizes, plus TO-5's and discretes with leads to .032" diameter.

Suggested retail price for the 101 is $84.95; 102, $114.95 and 103, $124.95. For more information contact Ken Braund, Product Marketing Manager, A P Products, 72 Corwin Dr., Box 110, Painesville, OH 44077.

CIRCLE INQUIRY NO. 203

"Wire-Wrap Jumpers" Save Time

The wire-wrap jumper cables provide a means for making temporary or permanent electrical connections between .025 inch square terminal posts, such as those commonly used in IC sockets, and printed circuit connectors. Small components such as diodes, resistors, and capacitors can also be temporarily connected using the jumpers.

The jumpers are available in lengths from 4 inches to 6 feet with five colors standard and unlimited variety available on request. Both assortments and color-code-by-length bulk packs are available. Contact surfaces are gold, rated 3 amperes continuous. The jumpers may be stacked up to 3-deep on a standard wire-wrap pin. Insulated sleeving ensures protection against shorts. Teflon wire and sleeving are available for hi-temp and hi-rel requirements.

Available off the shelf from many distributors or American Data Cable, Inc., 903 San Antonio Rd., Los Altos, CA 94022, (415) 328-7176.

CIRCLE INQUIRY NO. 204

Commercial Software for DECstation

New DECstation software packages, including a commercially oriented version of BASIC and a multifunction (symbiont) capability, are part of a new version of the OS/78 operating system. They increase the functionality of the DECstation, which is a low-cost, PDP-8-based, video data processor system.

The new commercial basic compiler's functions include commercial decimal arithmetic to 15-digit precision, a PRINT USING statement for formatted printing of numeric strings, a new record-oriented random-access I/O for rapid storing and retrieval of individual file records, and multiple data formats.

The new multi-function feature permits parallel operation of tasks in the upper 4K words of the DECstation's memory. This concurrent processing feature runs in parallel with other functions of OS/78. Typical concurrent tasks would include communications, I/O spooling, or monitoring real-time jobs. A printer-spooler program is included as part of the new OS/78.

For more information contact Digital Equipment Corp., Maynard, MA 01754, (617) 493-3300, John Bond.

CIRCLE INQUIRY NO. 205

dex 5100® Digital Facsimile Transceiver

The dex 5100 is a high-speed digital facsimile transceiver capable of sending or receiving a full page of text or graphics in as little as 20 seconds.

Standard features of the dex 5100 digital system include modular microprocessor architecture, automatic document feed, unattended operation and convenience copying capability. Automatic dialing from internal electronic telephone directory, simultaneous send-and-receive capability, and compatibility with high-speed analog devices are optional features.

The basic dex 5100 may be purchased for $12,000 or rented for $300 a month on a one-year contract. The auto dial option is priced at $1,500 or $30 per month on rent.

For details and further pricing information contact Graphic Sciences, Inc., Danbury, CT 06810.

CIRCLE INQUIRY NO. 212

Gold-Metallized Cable TV Modules

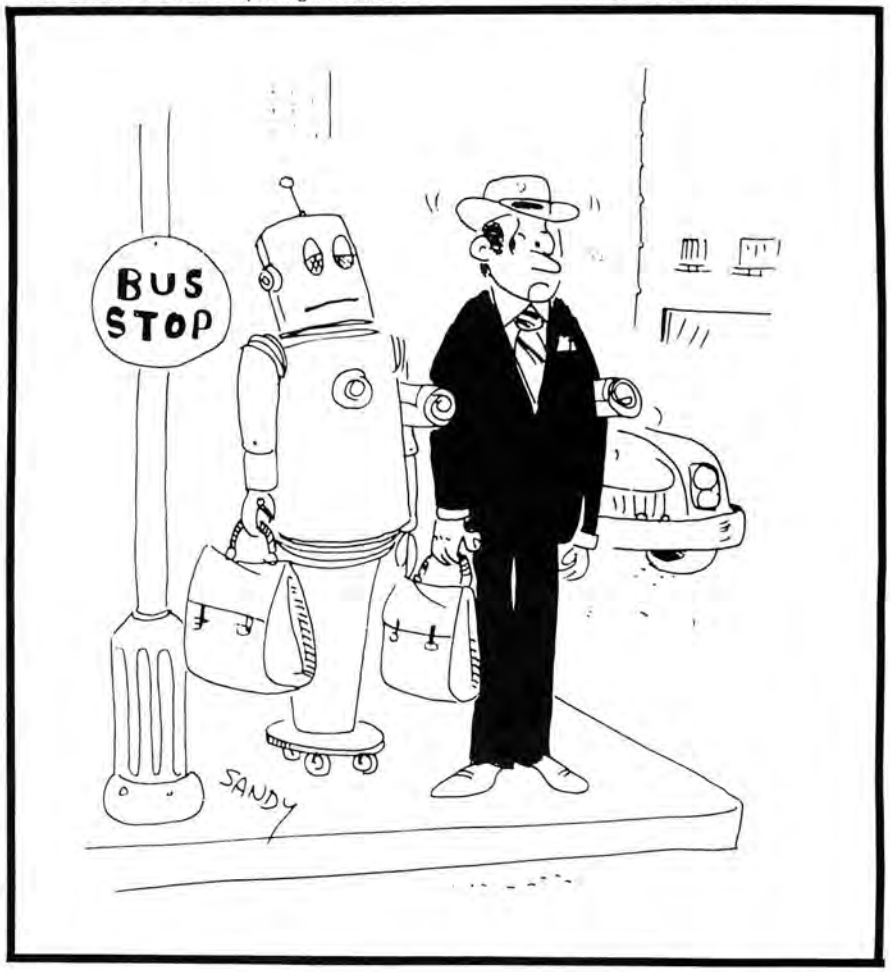
The MHW1000 series of ten new Hybrid CATV Modules from Motorola features all-gold metallized transistors, wires and substrates. Elimination of dissimilar-metal interfaces aids reliability.

Improved geometry transistors are used in the push-pull cascode configuration, reducing 35 channel cross modulation distortion by a factor of 3 dB, and 35 channel composite "triple beat" distortion by 3½ dB. While Noise Figure has been improved by over ½ dB, precise 75 ohm impedances reduce cable reflections.

With the exception of the 5-120 MHz MHW1182 Reverse Amplifier, the CATV line operates in the 40-300 MHz spectrum. The all-gold line replaces the existing Motorola CATV series, with no user cost penalty.

For more information and prices contact Motorola Semiconductor Products, Inc., P.O. Box 20912, Phoenix, AZ 85036, (602) 244-6393, Alan Wagstaffe.

CIRCLE INQUIRY NO. 209



Payroll

The MCBA Payroll Operating System is a general purpose business program designed to operate on the North Star Micro Disk system. The program is designed for hourly employees with weekly pay periods, and for salaried employees with weekly, biweekly, bimonthly, or monthly pay periods. Employee data and payroll data are easily created and edited. Reports on employee data, payroll, and summaries are generated.

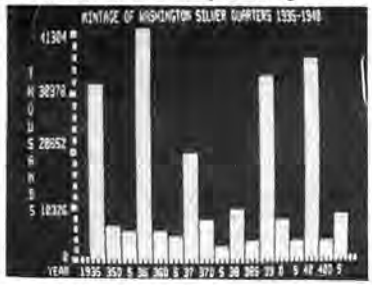
Federal and California withholding tax, FICA and California State Disability Insurance are calculated. The user is prompted for all commands; error messages are provided throughout; and little operator training is required.

The standard one disk drive system with 24K of RAM supports up to 20 employees for one year or 40 employees for ½ year for the weekly payrolls. Special versions are available. The standard hourly-weekly, salaried-weekly, salaried-biweekly, salaried-bimonthly, or salaried-monthly versions are each $75.00. For further information contact MCBS, 560 Bellwood Dr., Santa Clara, CA 95050, (408) 253-3240.

CIRCLE INQUIRY NO. 213

Interactive Graphics Plotting

Sunset Technologies announces a new piece of application software: a histogram program designed to draw a bar or point graph on a video screen from data inputted by the keyboard or from data already residing in memory.



The program, written in 8080 machine language and using less than 4K RAM, runs on a Poly-88 microcomputer. Program documentation includes: program description, complete operating instructions, flowchart, complete annotated source listing with object code, cassette tape containing object code and sample data bases in Byte format, and instructions for adding other routines to this program.

Single quantity price is $25 with dealer discounts available. For more information contact Sunset Technologies, 210A E. Ortega St., Santa Barbara, CA 93103.

CIRCLE INQUIRY NO. 214

Bimonthly Newsletter on 1978 National Computer Conference Published by AFIPS

The illustrated newsletter provides news, feature articles, interviews plus additional information on the 1978 National Computer Conference to be held June 5-8 in Anaheim, California. Complimentary Subscriptions to the newsletter, NCC Preview, may be obtained by contacting AFIPS, 210 Summit Ave., Montvale, NJ 07645, (201) 391-9810.

The first issue of NCC Preview provides an overview of the conference, information on the record-setting exhibit program, an outline of areas to be covered by the technical and professional program, a profile of conference chairman Stephen W. Miller and his plans for NCC '78, preliminary informatin on the NCC Travel Service, plus a report on activities planned for the NCC '78 Personal Computing Festival. The issue also contains a postage-paid reply card which may be used to pre-register for the full conference or to obtain additional information.

CIRCLE INQUIRY NO. 210

Multi-Drive Floppy Disk Drive Enclosure

Industrial Micro Systems, Inc., announces a triple disk drive enclosure with self-contained power supply and AC Line Cord. It allows the user to write protect his program disk and still have the use of 2 full disks for storage and copy.

The enclosure will accept Shugart 801, 851 and PerSci 277 drive types. It is designed for desk top, Product Model No. 61-0030 with solid wood sides or 19" rack mount Product Model No. 61-0020 with slides.

For pricing and additional information contact Industrial Micro Systems, Inc. 633 W. Katella Ave., Orange, CA 92667, (714) 633-0355.

CIRCLE INQUIRY NO. 211

"WORDPAL" Word Processor

Wordpal products business letters, assembles long contracts or proposals from standard "boiler plate" which may be individualized automatically, produces working drafts of documents requiring several revisions, retypes an "original" letter to each of hundreds of names on a list of clients, prospects, friends or colleagues, and maintains files of documents, lists, and commonly used forms.

This powerful system, which may also be used for a variety of data processing functions as well, is available only at Computer Power & Light stores. Prices start at $6575 or $171 per month on a 5-year lease/purchase. Additional work stations start at $2490, or $65 per month. For more information contact Computer Powre & Light, 12321 Ventura Blvd., Studio City, CA 91604, (714) 565-2041 or (213) 760-0405, Irv Kalb, Dir. of Marketing.

CIRCLE INQUIRY NO. 215

Micrprocessor Hardware/Software/Services

Wince 6800 Micromodules (MPU, I/O, RAM, EROM programmer, ADC/DAC, Driver/Sensor, Floppy controller, etc.) on 4½" cards.

6800 cross and resident software (assembler, PL/W, relocating linker, simulator, editor, monitor/debugger, BASIC); custom systems, consulting, in-house hands-on microcomputer courses. For more information, contact Wintek Corp., 901 N. 9th St., Lafayette, IN 47904, (317) 742-6802.

CIRCLE INQUIRY NO. 216

Third-Level Firmware/Software Package

A third-level firmware/software package is available from Pick & Associates for upgrading all Reality computer systems now installed and operating in he field, incuding those supplied by Pick.

Designated as Release 77, the new enhancement package consists of a single firmware board to replace the present firmware board, plus a system-generation tape to provide upward compatibility with all second-level Reality operating systems.

Release 77 software enhancements are also aimed at increased versatility and more efficient use of the Pick-Reality system resources. A fixed workspace allocation, for example, reduced the load on the disk, and magnetic tape records have been extended. A single dictionary can be shared by multiple data files. The Pick Release 77 system command specification is more universal and consistent. The Pick-Reality sort capability has been exploded to enable sort on multi-valued attributes, and the select capability has been expanded to enable the implementation of pseudo-indexed sequential files.

The Pick Release 77 firmware/software package for Pick-Reality computer systems is available for installation at a cost of $2,500 for single units. For further information contact Pick & Associates, Inc., 17911-E Skypark Circle, Irvine, CA 92714, (714) 979-6663.

CIRCLE INQUIRY NO. 222

Software — Ready to Load & Run

Software Ltd. announces the availability of a BASIC language library of programs ready to run on North Star disk media.

These programs are 'bug-free' and ready to run. Over 45 programs, including business, finance, family budget, and games are immediately available. Most programs are priced from $2 to $5 each.

For more information contact Software Ltd., Box AF, Woodbridge, CT 06525.

CIRCLE INQUIRY NO. 223

SMAL/80

The SMAL/80 is a compiled, structured, macro-assembly language for 8080 and 8085 microprocessors that requires only 7K of memory.

SMAL/80 statements are written in a symbolic notation resembling PASCAL and PL/M that simplifies considerably the writing of assembly language programs.

The SMAL/80 package includes a 2K macro preprocessor written in SMAL/80 that greatly extends the usefulness of the language. The macro preprocessor permits conditional expansion of statements, unlimited nesting of macros, and has a natural notation that is conducive to efficient, error-free programming.

SMAL/80 is being offered initially in CP/M and Isis I disk formats. Price, including documentation, is $75. For more information contact Chromod Associates, P.O. Box 3169, Grand Central Station, New York, NY 10017.

CIRCLE INQUIRY NO. 224

The 6502 Program Exchange

The 6502 Program Exchange has released a number of software packages for 6502 systems. These include an extended version of the high-level language FOCAL, a 4K resident assembler, and an efficient Mini-Editor.

The FOCAL is called FCL65E (6.5K) and offers 8 to 9 digit accuracy, 8-level priority interrupt handling, string variabls and functions.

A Mini-Manual ($6) and a paper tape or hex dump ($17) will get you started on TIM or KIM systems. A User's Manual, 104 pages of FCL65E examples and further documentation is available for $12.

For more information and a list of other available software send $1.00 to The 6502 Program Exchange, 2920 Moana, Reno, NV 89509.

CIRCLE INQUIRY NO. 341

Computer Mainframe Systems

The Model MCS-112 is a foundation unit based on an S-100 bus system with a 12-slot motherboard. The power supply is rated at 17 amps at 8 volts and 2 amps at ± 16 volts.

A second version is Model MCS-122. A foundation unit also featuring the S-100 bus system with a 22-slot motherboard and a higher rated power supply providing 32 amps at 8 volts and 4 amps at ± 16 volts.

Both models are fully assembled and tested and are priced at $395.00 for the MCS-112, and $495.00 for the MCS-122. For more information, contact CMC Marketing Corp., 5601 Bintliff, Suite 515, Houston, TX 77036, (713) 783-8880.

CIRCLE INQUIRY NO. 219

Rectifiers Supply Up to 16KV

Two new types of high-voltage rectifiers combine the high peak-reverse voltage and moderate current characteristics that make them ideal for microwave tube, laser, x-ray, or other high-voltage applications.

One 13-device axial-lead series, numbered from 1N2372 through 1N2385, exhibits PRVs from 420V to 10,000V with average rectified currents from 250mA to 70mA, respectively. Forward voltage drops, at 100mA, range from 3V at 420V to 39V at 10kV. Case dimensions are .5" long and 0.363" in diameter for the lower voltage devices up to 2" by .5" for the high voltage units.

The axial-lead rectifiers are priced from $0.66 each to $7.29 each in 100 unit quantities while the ferrule type devices are priced from $2.10 each to $6.75 each in 100 unit quantities. Delivery is stock to 30 days.

For more information contact Solid State Devices, inc., 14830 Valley View Ave., La Mirada, CA 90638, (213) 921-9660.

CIRCLE INQUIRY NO. 148

TTL Fiberoptic Duplex Data Link for Large Bandwidth Applications

A fully engineered, duplex, asynchronous, TTL fiberoptic data link is now available from Valtec Corporation. Each end of the link has a self-contained optical transmitter, optical receiver and power supply. The electrical signal input and output is through standard BNC connectors. The link is powered by ordinary wall current using the power cord which is supplied.

The user only has to plug in the link and connect the electrical and optical cables to activate the system. No adjustments are required. Valtec sells the duplex fiberoptic cable with attached connectors for about $1.00 per foot.

The link and terminated cables are available from Valtec with 4-6 week delivery. The price for a duplex link pair is approximately $1300 plus cable costs. For more information contact J. Morris Weinberg, Valtec Corp., West Boylston, MA 01583, (617) 835-6082.

CIRCLE INQUIRY NO. 150

10-Million Character Business Computer System

The System 3000/Model 60 has 10 million characters of disk storage for $698 per month. The new product features a multi-terminal commercial timesharing capability, designed for use in a commercial environment.

Also available is a comprehensive Integrated Accounting and Distribution system that will handle many common accounting problems. This product is targeted for distributors, manufacturers, CPAs and service companies. These packages include general ledger, accounts receivable, accounts payable, order entry, invoicing, purchasing, inventory control, payroll and word processing.

The Model 60 also features remote diagnostic support, which allows immediate diagnosis of most service problems over the phone.

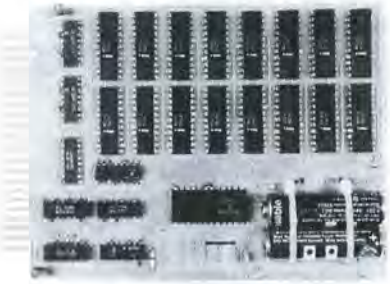
Standard peripherals include a graphics video terminal, 120 line per minute line printer, one 10-million character disk drive with 5 million characters of fixed and 5 million characters of removable memory. The Model 60 includes all of the interfaces and controllers necessary to operate the basic peripherals plus a modern walnut grained system enclosure which integrates well with any contemporary office decor.

The base system price is $33,270. This corresponds to a monthly lease rate of only $698 per month via third party sources. For information contact Advanced Information Design, Inc., 1240 Elko Dr., Sunnyvale, CA 94086.

CIRCLE INQUIRY NO. 158

Non-volatile CMOS RAM Module Price Down 62%

Wintek has lowered the price on their 2K CMOS RAM/BATTERY Module from $899.00 to $349.00. The new price for 256 bytes is $129.00.



The Module can be loaded with any multiple of 256 8-bit bytes up to 2K along with automatic battery backup. Increased volume and plummeting prices for the 510L CMOS RAM chips were cited. Wintek claims the most complete line of 6800 microprocessor and interface modules on industry standard 4½" x 6½" 44-pin boards.

For more information contact Wintek Corp., 902 N. 9th St., Lafayette, IN 47904, (317) 742-6802.

CIRCLE INQUIRY NO. 151

Hobby Computers Replace Costly Edit Code Readers

The most recent addition to the growing list of business oriented "software" is of specific interest to firms using Audio/Visual communications.

A giant step forward was taken in the assembly of films and tapes when the Society of Motion Picture and Television Engineers (SMPTE) unveiled its "Time Code Standards" for indexing films and tapes. A Chicago-based consulting firm has announced the first in a proposed series of operating systems written for micros.

The program uses any 8080-based microcomputer to read time and coded films and tapes. The display is in plain everyday language. The program is written in 8080 assembler, so no high level language is required. It is supplied on punched paper tape with a manual complete with source listing.

The software package is priced at $49.00 postpaid, which includes one pre-soldered, tested interface module. Additional interface modules are $7.50 each, postpaid. For additional information write to J.S. Wiener, 4440 N. Kedzie Ave., Chicago, IL 60625

CIRCLE INQUIRY NO. 147

Tektronix Logic Analyzer Line

A new logic analyzer display formatter that monitors, in sequence, activity that occurs on the IEEE-488 (General Purpose Interface) Bus is now available from Tektronix, Inc. Designated the Tektronix DF2, the formatter makes it substantially easier for users of programmable instrumentation to link different types of instruments to a digital controller for display and analysis in a variety of applications.

Price of the DF2, including the IEEE/GPIB Probe Adapter, is $1945. Delivery is four weeks ARO. (Price and availability applicable only to the U.S.A.).

For further information contact Tektronix, Logic Development Products, P.O. Box 500, Beaverton, OR 97077, (503) 644-0161.

CIRCLE INQUIRY NO. 153

Z-80 Based Development Systems

MICROSYSTEM/12, MICROSYSTEM/15 (tape-based), MICROSYSTEM/20 AND MICROSYSTEM/30 (disk-based) Z-80 systems include CPU with up to 56K memory, high speed 960 character CRT, ASCII keyboard, dual floppy disk or cassette tape unit, operating system software and documentation.

Optional accessories an software include in-circuit emulator, line printers, extended BASIC, BASIC compiler, RDOS (disk operating system with relocatable macro assembler and linkage editor), and word processor. Low cost plug-in modules permit the systems to be converted to 8080 or 6800 processors.

Prices range from $4,325 for MICROSYSTEM/12 MOD Z-80 with MICROTAPE/2 dual cassette tape unit and 16K memory, to $7.675 for MICROSYSTEM/30 MOD Z-80, including MICRODISK/2 dual 8" floppy disk unit and 16K memory. Delivery for all systems is 2 to 4 weeks. For additional information contact Futuredata Computer Corp., 11205 S. La Cienega Blvd., Los Angeles, CA 90045, (213) 641-7700.

CIRCLE INQUIRY NO. 112

1978 Catalog

Power One, producer of open frame D.C. power supplies, has just published its new 1978 product catalog.

The catalog includes complete specs, prices, photos and mechanical drawings of 83 specific models . . . all stocked for immediate delivery. It also presents a rep list and nationwide stocking centers plus other information that enables the user to buy directly from the catalog.

For a free copy of the new 1978 catalog contact Power One, Power One Drive, Camarillo, CA 93018, (805) 484-2806.

CIRCLE INQUIRY NO. 221

Metric Precision Gear Boxes

PIC Design has a complete series of metric precision gear boxes . . . choose from servo, worm and wheel, miter and bevel gear boxes.

Designed to change the direction of speed or to precisely geardown and reduce the outputs of high-speed servo motors that must be used with slower speed devices. Enables the designer to have a wide range of packaged speed reduction units to choose from to meet virtually any design requirment.

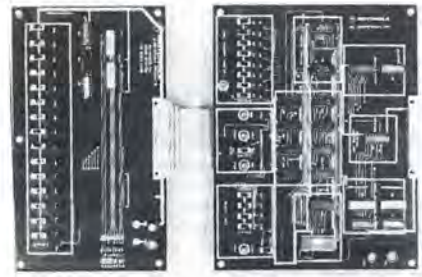
Available in ratios 1:1; 1:3; 12,5:1 — 120:1 and 2:1 — 625:1 backlash as low as 0°-10′, up to 5000 RPM max. Over 100 different variations and models supplies in shaft sizes 3, 4 and 6mm. Special ratios, shaft sizes or locations of input and output shafts can be supplied upon request.

Prices from $95.50. For more information contact PIC Design Div., Wells-Benrus Corp., P.O. Box 335, Benrus Center, Ridgefield, CT 06877, Attn: Catalog Dept.

CIRCLE INQUIRY NO. 220

FM Stereo Demodulator Uses I²L, Ion Implant & Bandgap Technologies

The MC1309, with pin connections identical to the industry-standard MC1310, combines the latest I²L, Ion Implant, and Bandgap technologies to meet the needs of today's FM stereo receivers. Low distortion, low power drain, minimized supply-line noise, and automatic transient-free stereo/mono switching are some of the benefits of the new design.



I²L technology permits efficient, low power drain operation of the PLL's logic circuitry, while Ion Implanting allows controller, high valued internal resistors to be fabricated. The MC1309 uses the lower noise Bandgap Reference technique, with the advantage of low supply voltage capability. Tree-type multiplying demodulators are replaced by parallel switching in the new wide range design.

The MC1309 is available from distributor and OEM stocks in a 14-pin DIP, at a 100-up price of $1.50. For more information contact Motorola Semiconductor Products, Inc., P.O. Box 20912, Phoenix, AZ 85036, (602) 962-3101, Doug Fryman.

CIRCLE INQUIRY NO. 217

Virtual Memory Box

The memory box contains a collection of 2102-M-816 memory boards. The nominal 64K workspace of a microprocessor is expanded to several megabytes, if necessary, by the concept of Virtual Memory; data lines are used to define a 24-bit addressing scheme instead of the conventional 16 address bits.

Typical applications range from ROM and bubble memory banks to memory shared multiprocessing; with Virtual Memory, DMA between two main processors of up to 64K is now possible in less than 10 usec by a simple instruction. The memory box can also be used for conventional memory expansion.

Send $2.00 for complete description with schematic diagrams (refund if material is returned by return mail) to: Systemathica Consulting Group Ltd., P.O. Box 10154, Pittsburgh, PA 15232, (412) 621-8362.

CIRCLE INQUIRY NO. 218

MLZ-80 Microcomputer Board

In addition to being a general purpose microcomputer complete with 4K RAM and up to 8K ROM, the MLZ-80 contains an *on card Floppy Disc* interface for standard or "mini" floppy disc drives.

Other special features of this 6.75 inch x 12.0 inch card are: Intel SBC bus compatible, *Dual* serial asynchronous/synchronous ports with separate software controllable baud rates up to 19,200 baud, RS232C or current loop interface, four 8-bit parallel ports (two of which have bidirectional capability), DMA logic for memory and I/O data transfers, four counter/timers, selectable power-on-jump starting address, full Z-80 vectored interrupt support, and multiprocessor capability.

Pricing is $350.00 and up, depending on configuration and quantities. The Heurikon Corporation also provides support and system development services for the MLZ-80 including general purposes or custom hardware interfaces and application software. Contact Heurikon Corp., 700 W. Badger Rd., Madison, WI 53713, (608) 255-9075 for informaton.

CIRCLE INQUIRY NO. 122

Velleda 'Writes On, Wipes Off'

Velleda, a dramatic new way to communicate in color. What is written on a special plastic surface may be wiped away in seconds, effortlessly, cleanly and without a trace.

The world's quickest writing and illustrating aid, Velleda is positioned as the most versatile and among the least expensive of all products serving the communications board industry. It consists of a self-adhesive board Flexiroll ready for mounting and special dry-wipe markers available in six assorted colors. The Flexiroll also may be cut to any size and applied to any flat surface to make a blackboard obsolete since it eliminates words, figures or graphics instantly with no rubbing, dust or marks left behind.

The smaller Velleda roll size (Item 67) is 26½ x 39⅜ inches and retails for $14.95. The larger roll (Item 90) is 35½ x 78¾ inches, selling for $39.95 list. The special dry-wipe markers, for use with Velleda Flexirolls are available in packs of one dozen at 89 cents each. The markers are also available in an assorted four-pack (blue, black, red, green) at $3.56 list.

A pre-pack counter display assortment (#8067) contain 15 No. 67-size rolls, a dozen markers with black ink, and a dozen four-pack assortments with a total retail value of $277.56.

Velleda will be distributed through office supply dealers, contract stationers, school and art supply wholesalers, college bookstores as well as distributors serving mass retail outlets. For more details contact Caractere Pen Corp., 124 W. Lincoln Ave., Mt. Vernon, NY 10550.

CIRCLE INQUIRY NO. 112

Tektronix Graphics Terminal Output for TV Display

Princeton Electronic Products, Inc., introduces a Computer Graphics Terminal Interface Option to its PEP-500 Image Memory/Scan Converter. This new interface allows direct plug connection of the PEP-500 to Tektronix Graphics Terminals, Models 4010, 4012, 4013, 4014, 4015, and similar terminals.

The PEP-500 converts graphics terminal X-Y signals into standard EIA composite video output, allowing group viewing of computer generated engineering, statistical or scientific graphics on TV monitors and projection TV systems, or recording of graphic material on standard video tape or disk systems.

For more information and technical performance data contact Princeton Electronics Products, Inc., P.O. Box 101, N. Brunswick, NJ 08902.

CIRCLE INQUIRY NO. 120

TIGER

The TIGER (Television Interface General-purpose Economy Remote terminal) contains an acoustic coupler for communications with remote time-share computers, full ASCII keyboard, and television electronics that provide interconnection to a standard TV set via the antenna input. Up to 1024 characters may be simultaneously displayed in switch selectable formats for 8 or 16 lines of 32 or 64 characters per line.

The unit has a built-in power supply, measures 8" x 10" x 3" and weighs only 4 pounds. Additional features include eight selectable baud rates from 110 to 9600, complete TTY compatibility, built-in RS-232C connector for direct hook up to a computer, an optional self-contained memory system and availability in eight colors. The TIGER terminal sells for $500.

For additional information contact Micon Industries, 252 Oak St., Oakland, CA 94607, (415) 763-6033.

CIRCLE INQUIRY NO. 137

Information Processors

The IBM 6/442 and IBM 6/452 Information Processors with high-speed impact printers are the latest additions to the IBM Office System 6 family.

The IBM 6/442 features a functional display, high-density diskette storage, a 96-character multilingual keyboard, and an impact printer with bidirectional print capability at speeds of up to 55 characters per second. The printer has an operator-changeable print wheel available in five typestyles, 10 pitch, 12 pitch and proportional spacing all with justification capability.

The IBM 6/452 has all the features of the 6/442 but also includes a magnetic card reader/recorder. This provides users the ability to utilize IBM mag card typewriters to process magnetic cards for text editing, record processing and high-speed impact printing.

The IBM 6/442 and 6/452 and be leased, rented or purchased. For more information contact IBM Corp., Office Products Div., Parson's Pond Dr., Franklin Lakes, NJ 07417, (201) 848-3454, Donald Reck.

CIRCLE INQUIRY NO. 117

Processor Terminal

The MCS-PT112/32 is a complete and self-contained computer system with display, disk storage, a full keyboard and a 12-slot motherboard. Features of the MCS-PT112/32 include a 15" high-resolution monitor with a face plate of smokey plexiglass to reduce glare and enhance type visibility; a full upper and lower case ASCII keyboard with eight user designated special function keys and a 16-key numeric cluster pad. One Shugart SA-400 mini-floppy disk drive is standard.

The 12-slot mainframe contains a CPU board that features an 8080 processor and a special circuit that implements a start up "jump to" routine to any user selected byte address.

The Processor Terminal Model MCS-PT112/32 fully assembled and tested is priced at $4795. Other models in the PT series are available. For more information contact CMC Marketing Corp., 5601 Bintliff, Suite 515, Houston, TX 77036, (713) 783-8880.

CIRCLE INQUIRY NO. 136

COMPAL-80 Business Microcomputer

The system is based on the S-100 standard COMPAL micro, with a dual Micropolis "quad density" mini-floppy drive (315K bytes per diskette), the Texas Intstruments TI-810 150 cps impact printer, and an extended disk BASIC with several enhancements/utilities.

Computer Power & Light provides three service plans, including a full maintenance contract, and offers classes in computer programming and in operation of their application software. Price of a 56K system is $7300, complete, or $190 a month on a 5-year lease/purchase. For more information, write COMPAL, 12321 Ventura Blvd., Studio City, CA 91604. No dealer inquiries please.

CIRCLE INQUIRY NO. 118

Power Supply Mounts on P.C. Board

Scientific Programming, Inc. is introducing a new quad output P.C. Board-mountable power supply to complement the company's DUAL-OUT & TRIOUT Series. The new unit is part of the Micro-Supply (MS) family. The MS family is a new concept in miniature power supplies. The family consists of a newly developed AC adaptor plus SPI's Regulated DC/DC converters. The AC adaptor is a wall plug-in unit designed to be compatible with all the converters manufactured by SPI. At the present time 18 types of power supplies with dual, triple or quad outputs are available.

The most popular module the QUADOUT 5/12/-12/-5 is priced at $59.95 in OEM quantities. Prices of other modules range from $29 to $79 depending on the type and the quantity. Delivery is from stock to 4 weeks. For more information contact Scientific Programming, Inc., 1499 Bayshore Hwy., Suite 126, Burlingame, CA 94010, (415) 493-2199.

CIRCLE INQUIRY NO. 154

Tape Transport

MFE Corporation has expanded its Hostile Environment Digital Cassette Tape Transport line for use in military and other hostile environment industrial and commercial applications.

MFE's new "low power" Model 250BH-1, which is capable of operating over a temperature range of minus 30°C to plus 55°C, is intended primarily for portable, battery-operated system applications.

The Model 250BH-1 supplements the present Model 250BH which is capable of operating over the temperature range from minus 40°C to plus 70°C. The 250BH has been qualified mechanically to MIL-E-5400R and MIL-STD-810C "Helicopter Environment" for vibration, shock and 30g crash safety.

For further information contact MFE Corp., Keewaydin Dr., Salem, NH 03079, (603) 893-1921.

CIRCLE INQUIRY NO. 126

D to A and A to D

Colorado Analog Products announces another handy P.C. board. This bare board is priced at $10 and implements two channels of digital to analog and 8 channels of analog to digital conversion, both 8 bits wide. The board is 3" x 4" and is designed to mount as a module on most standard proto boards, but may also be mounted independently.

The board uses two MC1408 type DACs whose gain and offset can be individually adjusted by trim pots. For special applications such as music synthesis there are jumper options for wide dynamic range (48dB) and zero D.C. signal generation. Three voltage supplies (+12, -12, +5), one input and two output ports are required.

For further information contact Colorado Analog Products, P.O. Box 6746, Denver, CO 80206.

CIRCLE INQUIRY NO. 122

Punched Tape Readers

The 2001-2 Step/Mate Reader is available for immediate delivery from stock from EECO.

The 2001-2 reader was designed for microprocessor software development, PROM programming, photo typesetting and machine control applications.

2001-2 reader specifications include punched tape reading at 150 cps, complete tape drive electronics and output/handshake signals that are TTL compatible.

The Step/Mate is compact in size, easy to connect to system electronics. Interface controllers are available for most popular minicomputers. 1-49 quantity list price is $290. For more information contact EECO, 1441 E. Chestnut, Santa Ana, CA 92701, (714) 835-6000, "Tape Readers."

CIRCLE INQUIRY NO. 131

6800 for S-100 Bus

Datatronics has announced a new 6800-CPU microprocessor card for the S-100 bus, bringing all the advantages of the 6800's sophisticated bus-oriented architecture and its comprehensive, PDP-11-like instruction set to the S-100 users. The extensive software support for the 6800 is available at last on the S-100 bus.

For the serious business user or hobbyist, this microprocessor card provides full turn-key operation and maximum system compatibility as well as an RS-232/20ma interface (baud rate selectable with a dip switch), paper tape reader control, Mikbug ROM Operating System, power on reset, on board dynamic memory refresh, slow memory interfacing (up to 5 μs access time), and tri-state data, address and control lines all on one card for $179.00 in kit form and $269.00 assembled, burned-in and tested.

A floppy disk system and other advanced support items will also be available soon.

For more information contact Datatronics, 208 E. Olive, Lamar, CO 81052, (303) 336-7956. Dealer inquiries invited.

CIRCLE INQUIRY NO. 111

EPROM Programmer

Smoke Signal Broadcasting has a new low cost 2708 EPROM programmer. Designated the POP-1, the unit lists for $149 and is designed to interface to the company's P-38-1 and P-38-FF EPROM boards, which are SS-50 bus compatible products.

Complete software is provided on audio cassette. A unique adaptive programming technique is used that allows most 2708's to be programmed in 15 seconds instead of the usual one and a half minutes. A separate self-contained power supply is used for the programming voltage insuring sufficient current capability to program EPROM's from any manufacturer.

For more information contact Smoke Signal Broadcasting, P.O. Box 2017, Hollywood, CA 90028, (213) 462-5652.

CIRCLE INQUIRY NO. 134

Hardware Switch

A printer switching capability that allows users of NBI word processing equipment to increase system throughput by up to 20 percent.

The product consists of an electronic switch and all required cabling needed to link the printer with multiple NBI systems. Printers typically used with this word-processing equipment are 30 - 40 - 55 cps daisy-wheel printers.

Priced at $11,990, it allows user to continuously update applications by entering software changes on the system's standard diskette, which stores approximately 250K characters, or about 50 pages of text.

For further information contact NBI, 5595 E. Arapahoe Ave., Boulder, CO 80303, (303) 444-5710.

CIRCLE INQUIRY NO. 124

New Course from NCR Teaches Basics of COBOL 74 Language

A new self-instruction course which provides basic skills for writing computer programs in COBOL 74 is now available from NCR Corporation.

The course, which takes approximatley 40 hours to complete, will enable those taking it to become entry-level programmers.

The course makes extensive use of exercises so that the learning of new material is constantly reinforced as the student takes an active part in the process. The course includes four student text volumes, a special monitor guide, a handbook, and a final examination, as well as programming forms.

It is general in nature and the language can be applied to both NCR and non-NCR systems. The course is priced at $225 and is available from the company's Learning Systems Division. For more information contact NCR Corporation, Dayton, OH 45479, (513) 449-2150.

CIRCLE INQUIRY NO. 152

Microcomputer with Double Density Floppy Disks

The Micro-2 is a high performance microcomputer system with dual-drive, double density floppy disks for less than $5,000. This compact system is housed in a single cabinet with two Shugart floppy disk drives. The single computer board features a Z-80 CPU, 32K or 64K RAM, four RS232 serial interfaces and real-time clock.

The Micro-2 Computer System comes completely assembled and tested. Prices with 32K memory is $4,995; with 64K memory, $6,090. A complete system with two double-sided drives with 32K memory is $5,695; with 64K memory, $6,795. Complete system with four single-sided drives with 32K memory is $7,040; with 64K memory, $8,135. First year srvice contract is available for $125. OEM and dealer discounts are offered. For information contact Digital Systems, 6017 Margarido Dr., Oakland, CA 94618, (415) 428-0950.

CIRCLE INQUIRY NO. 119

Mass Storage Operating System

The MSOS II is a Mass Storage Operating System for DG NOVA or NOVA emulating computers which supports from one to nine mass storage devices, high speed reader and punch, line printer, and system console. MSOS II is independent of any hardware manufacturer and will support any combination of devices, including user-supplied devices. It is ideal for applications programs development and file management.

All software is operational in the minimum configuration of one 16K NOVA and one mass storage unit. System resident software occupies only 350 words. System overlays occupy an additional 1800 words during execution of system commands. Standard MSOS II includes an Editor, Relocatable Assembler, Linker and Extended BASIC. Rela extensions to the standard basic interpreter include extended precision calculations, complete string functions, and PRINT USING.

Optional MSOS II utilities include a Macro Assembler, Library File Editor, Cross Assemblers for Intel 8080, MOS 6502, and Motorola 6800 microprocessors, and support utilities for Indexed Sequential Access Method.

Purchase price for the standard system is $1,000 with substantial OEM discounts available. MSOS II is available from Rela Systems, inc., 303 Canyon Blvd., Boulder, CO 80302. For more information contact Dean Leffingwell, (303) 444-1738.

CIRCLE INQUIRY NO. 128

Industrial Control Microcomputer

The Wyle line of microcomputers and *digital* logic modules includes parallel and serial digital I/O, analog I/O, communications modules, and a wide variety of others including over 200 digital logic modules.

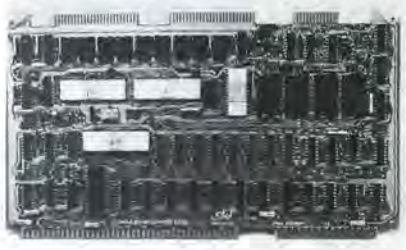
Also available are modules to allow the Wyle microcomputer hardware to couple directly to existing 4-20 and 10-50mA current loops. The modularity in design and assignment of specific functions to individual modules allows systems to be tailored to customer requirements in control and data collection. The Wyle software includes resident and non-resident assemblers, development packages, math utilities and a high level language.

For a descriptive brochure or more information contact Wyle Laboratories/Computer Products, 3200 Magruder Blvd., Hampton, VA 23666, (804) 838-0122.

CIRCLE INQUIRY NO. 116

Intel's Improved Single Board Computers

The iSBC 80/10A Single Board Computer is an enhanced version of the popular iSBC 80/10. The 80/10A differs in that it gives the user up to twice the ROM capability as is presently available on the 80/10 at no increase in cost. The 80/10A sells for $495 in single quantity.



With the 80/10A, the user creates the features of his end product by configuring his software and storing the program in either erasable and electrically reprogrammable EPROM or mask programmable ROM, which are then added to the 80/10A.

For further information contact Don Schare, Intel Corp., 3065 Bowers Ave., Santa Clara, CA 95051, (408) 987-7253.

CIRCLE INQUIRY NO. 114

KX-33B Microcomputer

The KX-33B is an easy-to-use microcomputer that is intended to teach the basic concepts of computer technology, including the execution

of functions by combining your instructions with input signals. The KX-33B is also intended to give some idea of microcomputer operation, introducing the world of the central processing unit, registers, and memory.

Since it is basically a controller, the KX-33B is built around the Panasonic 4-bit MN1400 microprocessor. In addition to the arithmetic/logic unit, the chip includes 1024 words by 8 bits of ROM for the system program and 64 words by 4 bits of RAM, which stores keyboard data. Also in the KX-33B are two static RAM chips with 256 words of 4 bits each, which hold the tunes keyed in by the user. It also includes an 8-bit latch, audio amplifier and multivibrator ICs, and a speaker. There are keyboard switches and LEDs and associated drivers for the 4-digit display.

Available completely assembled, the KX-33B is priced at $229.00 with instruction manual included. For further information contact Energy Electronic Products Corp., 6060 Manchester Ave., Los Angeles, CA 90045, (213) 670-7880.

CIRCLE INQUIRY NO. 115

Two Pounds of RF Data from Motorola

The RF Data Manual is packed with complete data sheets, practical application notes, and cross-references. The two pound, 736-page volume describes RF Power Transistors with outputs up to 150W, operable in commercial, military, aircraft, marine and ham bands from 1.5 MHz to 1 GHz, as well as linear hybrid amplifier modules for CATV/MATV and general purpose use, power hybrid amplifiers up to 30W output in the VHF and UHF bands, and Small-Signal RF transistors with f_T values up to 6 GHz.

Detailed application information includes impedance matching networks, mechanical RF

construction techniques, biasing, reliability, noise figure and gain optimization procedures, mounting and heat sinking, as well as discussions of SSB linearity, broadbanding, and power combining. Specific amplifier configuration articles include actual printed circuit board layouts.

Motorola's RF Data Manual is available for $3.50 each from all Motorola distributors. For more information contact Motorola Semiconductor Products, Inc., P.O. Box 20912, Phoenix, AZ 85036, (602) 244-6900.

CIRCLE INQUIRY NO. 113

Dual Processign Satellite and Floppy Disk Controller

The dual processing and floppy controller board 1771-AC-1051 is designed to provide the ultimate power to this peripheral control.

The Controller Module is a smart, FD 1771 based multi-drive unit which automatically performs all elementary disk operations including CRC checks.

The Arbitration Module is an interrupt driven dual processor communication unit which allows two microprocessor systems to communicate data and control signals directly between one another, to share the same memory and to access the controller module independently.

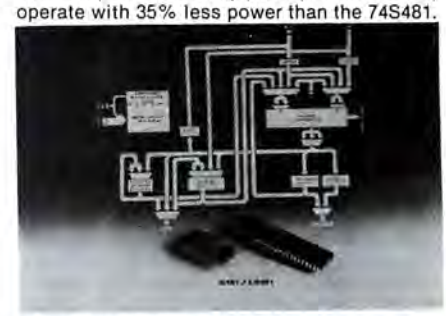
It is available as a kit or as a complete satellite, including the slave micro-unit, memory box and a powerful disk operating system. 1771-AC-1051 kit, including PC board, all passive devices and TTL gates is $171.00; sockets, $25.00; chip set, $71.00; Dual processing satellite (specify bus option) assembled and tested is $1200.00.

Senf $2.00 for complete description with schematic diagrams (refunded if material is returned by return mail) to Systemathica Consulting Group, Ltd., P.O. Box 10154, Pittsburgh, PA 15232, (412) 621-8362.

CIRCLE INQUIRY NO. 133

High Performance 4-Bit Slice Processors

Texas Instruments' S481 4-bit slice processors offer built-in computational algorithms. Part of the S481 chip set of Schottky TTL microprogrammable building blocks, the SN74S481 offers a 10Mz clock rate, while the new low-power Schottky parts (SN54/74LS481) operate with 35% less power than the 74S481.



Both the S481 and LS481 versions are now available in the hermetic 48-pin quad-in-line ceramic package, and they will be available soon in a lower-cost 48-pin dual-in-line plastic package.

The SL/S481 bit slice processor is now available in high-density ceramic quad-in-line packages for either commercial (0° to 70°C) applications, and the SN54LS481 is available for -55° to +125°C requirements.

Please forware inquiries to Texas Instruments, Inc., Inquiry Answering Service, P.O. Box 5012, M/S 308 (Attn: S481), Dallas, TX 75222.

CIRCLE INQUIRY NO. 110

Floppy Disk System

Model 61-0041 is a full sized floppy disk drive with I/O Controller for the S-100 bus, fully assembled and tested. A portable self contained enclosure with Shugart 801R floppy disk storage drive.

Forced air flow by "Whisper Fan." 50/60 Hz 110 volt or 220 volt operation — AC to DC power supply. Double disconnect power cord UL/CSA/VDE approved. Fused AC and DC. Steel cabinet construction. The I/O Controller is fully Altair compatible. Also available with triple drive enclosure.

For further information contact Industrial Micro Systems, 633 W. Katella Ave. -L, Orange, CA 92667, (714) 633-0355.

CIRCLE INQUIRY NO. 135

The Data Handler Expansion Board

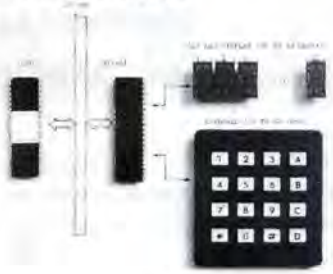
This board will expand the Data Handler into a much more professional system. The expander board will contain 4K of RAM (expandable to 16K), 1K of EPROM (expandable to 4K), Video Interface with RF modulator 64 characters by 32 lines, and features a cassette operating system software package to promote the Data Handler into a powerful system.

The Data Handler expander board is available now for $315.05 and can be purchased through Western Data Systems, 3650 Charles St., Dep. H., Santa Clara, CA 95050. Or see one of our dealers.

CIRCLE INQUIRY NO. 121

MTX-A1 Alpha Chip

The MTX-A1 (alpha chip) is a general purpose programmable alphanumeric display and keyboard interface device designed for use with most 8-bit microprocessors. The display portion provides all the timing and refresh signals to drive up to 32 popular 5x7 dot matric LED displays. The keyboard portion provides all scanning signals to debounce and decode any keyboard of up to 64 keys.



On the input side, the alpha chip interfaces directly to the address, data and control busses of most 8-bit microprocessors.

The MTX-A1 incorporates virtually all functions on one chip. It works with any 5x7 dot matrix LED. Typical examples are the TI-TIL305, or the HP HDSP-2000. It has a 32x8 display refresh RAM built in as well as a 64x5x7 ASCII character generator ROM. The device will encode and debounce any keyboard of up to 64 keys in 16 msec.

The IC requires a single +5V ± 10% power supply (60mA). All display and keyboard I/O pins are TTL compatible. The price is $39.00 single, $29.00 for 100. For further information contact Matrox Electronic Systems, P.O. Box 56, Ahuntsic Stn., Montreal, Que H3L 3N5, (514) 481-6838.

CIRCLE INQUIRY NO. 127

Remote Journal and Administrative Printer

A remote journal and administrative printer that can be shared by several transaction terminals has been introduced by Concord Computing Corporation.

The Concord 700 Journal and Administrative Printer lets you maintain a continuous, consolidated printed record of all transactions made on up to eight Concord terminals. Retained in a locked compartment for security, this record helps simplify account balancing and reconciliation. The 700 printer can also receive host computer generated administrative messages, annotations to transactions and warnings of anticipated system problems. It can operate remotely from the transaction terminals and requires no host computer programming or modifications to the terminals.

The Concord 700 sells for $1600 each. Quantity discounts are available. For more information contact Concord Computing Corp., Irwin Abrams, Vice President, 7 Alfred Cir., Bedford, MA 01730, (617) 275-1730.

CIRCLE INQUIRY NO. 129

12-Bit Hybrid Data Acquisition System

Models HDAS-16 and HDAS-8 are complete 12-bit data acquisition systems fabricated with thin-film hybrid technology. These complex hybrid devices incorporate a CMOS multiplexer, programmable gain instrumentation amplifier, sample-hold, 10V buffered reference, 12-bit A/D converter, address register, and digital control logic into a miniature 62-pin package 2.3 x 1.4 x 0.24 inches (58.4 x 35.6 x 6.1 mm).

The two models are 16 channel single-ended (HDAS-16) or 8 channel differential (HDAS-8) and feature a throughput rate of 50 kHz at 12 bits resolution. The performance of these devices equals or exceeds that of larger data acquisition system modules.

Pricing in 1-9 quantity ranges from $295.00 to $695.00 depending on temperature range desired. Availability is 4 weeks. For more information contact Datel Systems, Inc., 1020 Turnpike St., Canton, MA 02021, (617) 828-8000.

CIRCLE INQUIRY NO. 130

High Speed, Fixed Head Printer

The EX-201 is a high speed, fixed head electrosensitive printer, designed for mobile printing, ticket printing, and other heavy duty applications.

The new printer operates from 12 volts DC and uses a new fixed stylus print head. The print head is in light contact with a drive roller which moves paper under the head at up to 6 inches per second. Alphanumeric printing speed is 800 cps and characters may be formatted horizontally or vertically on the paper to give line printing or message printing as desired.

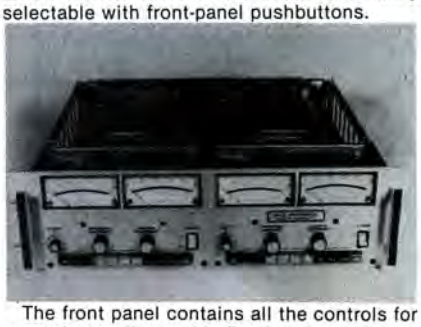
The EX-201 mechanism is available to OEM's at $180 each in 100 unit quantity. For further information contact Simon Harrison, Axiom Corp., 5932 San Fernando Rd., Glendale, CA 91202, (213) 245-9244.

CIRCLE INQUIRY NO. 125

Dual Rack-Mounted Programmable Load

A dual, 19-inch, rack-mounted version of the EL-750 programmable electronic load is capable of verifying DC power supply outputs as high as 1500 watts.

Designed for use in laboratories and in quality control and incoming-inspection stations, the dual EL-750 operates in either a constant resistance or constant current mode, manually selectable with front-panel pushbuttons.



The front panel contains all the controls for manual operation and indication. Load current programming can be accomplished by a steady DC voltage level externally applied through a connector mounted on the rear panel.

The EL-750 is also available as a single 750-watt rack-mounted or bench-top instrument.

Price for the dual rack-mounted version is $1,790.00; the single rack-mounted version is $995.00; the bench-top model $895.00 (1-9 qty.). Delivery is from stock. For more information contact Bob Hecton, ACDC Electronics, 401 Jones Rd., Oceanside, CA 92054, (714) 757-1880.

CIRCLE INQUIRY NO. 139

WHAT DO YOU REALLY NEED WHEN YOU BUY A COMPUTER SYSTEM?

When you buy a computer system from MISSION CONTROL you get three things: THE BEST PRICE, THE RIGHT COMPONENTS, AND THE SUPPORT TO GET IT UP AND RUNNING.

OUR SYSTEM PRICES ARE UNBEATABLE. We guarantee compatible components. Before you buy come by our store for "hands-on" experience on our demonstrators. Many people will try to save a few dollars by buying a piece here and a piece there, but when your system doesn't run who do you turn to?

At Mission Control we stand behind everything we sell with guidance and technical support. From our store you'll not only get what you want but also everything you need including peace of mind.

IMSAI 8080
22 slot, front panel, kit **$599**

APPLE II 16 KRAM
Color graphics **$1455**

SOROC IQ 120
Block mode **$995**

TI PROGRAMMER
Binary, hex converter **$49**

MICROPOLIS DUAL FLOPPY
630 K bytes **$1799**

NORTHSTAR FLOPPY
90 K bytes, kit **$599**

NORTHSTAR HORIZON II
Dual floppy, 32K RAM Soroc IQ 120. Basic Centronics 779 printer plus general business software **$4750**

ALPHA MICRO SYSTEMS
Power of a mini at the price of a micro

AM 100 —
2 board CPU **$1495**

AM 200
Floppy disk controller **$695**

WE THINK IT TAKES MORE THAN JUST HARDWARE TO MAKE A COMPUTER SYSTEM

MISSION CONTROL

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213 - 829-5137

T-Sat 11-6 Th 11-9

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ADDRESS _____

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(_____) _____
PHONE

☐ CHECK ☐ MONEY ORDER
☐ VISA ☐ MASTER CHARGE

CARD # _____

INTERBANK # _____ EXP. DATE _____

item	price
tax	
total	

CA. RES. ADD 6% TAX. All prices cash. Credit cards add 3%. Shipping charges add $15 for computers, terminals, $10 for floppies, $5 for boards, $2 per calculator.

ASSEMBLED SYSTEMS
With Disk Capability
AT KIT PRICES!

ISN'T YOUR TIME WORTH $58.00?

Then why spend needless time and energy when we will deliver assembled and fully tested systems, like this one.

Ideal for the BUSINESS OFFICE or the CLASSROOM

North Star HORIZON

North Star Horizon Single Drive System includes the Z-80 CPU at 2 or 4 MHz, motherboard, 16K of memory at 4 MHz and power supply. Software includes Disk Operating System and Disk BASIC. Horizon 1 kit is $1599. Dual Drive Horizon is also available at $1999.

We add monitor and keyboard.

Compare our assembled prices and save hours of soldering, testing and trouble shooting!

Here is what you would pay if you bought these components as separate kits.

Component
North Star HORIZON 1
Parallel Input/Output
PROM
Video Board (64 by 16) ✱
9" Video Monitor
ASCII Keyboard and Enclosure

Your cost for separate kits would total $2238.00.

Your assembled price from Sunshine Computer Company is $2296.00.

OPTIONS

✱Move up to a **Hazeltine 1500 CRT Terminal** for an additional $595.00.

Dual Drive $395.00

Assembled systems sold with 90-day written warranty.

Come in and see our Horizon in operation.

SYSTEM SOFTWARE GIVES YOU TRUE DISK FILE CAPABILITY

You get the Horizon 1 complete with North Star Disk BASIC. Business software on diskette is also available with the purchase of your Horizon 1 for $295, and includes:

- General Ledger
- Accounts Receivable
- Accounts Payable
- Payroll
- Inventory
- Amortization
- Mailing List

Each program is available for $60 and all programs may be purchased separately for $395.00.

Sunshine Computer Company

20710 South Leapwood Ave. • Carson, California 90746 • (213) 327-2118

Sunshine Computer Company

PROUDLY OFFERS SYSTEM THREE

From Cromemco

Brand New! FOR TIME SHARING

A Powerful Microcomputer System with Capacity for 4 DISK DRIVES!

SYSTEM THREE includes:

- Z-80A Microprocessor
- 32K of RAM on 2 cards
- Dual Disk Drive
- 4-Drive Controller
- RS-232 Interface
- S-100 Bus
- Power-On Switch
- 21-slot Motherboard
- Heavy Duty 30 amp Power Supply
- 110 or 220 Volt Operation

Price starts at $5990* assembled and tested.

Model 3100 CRT Terminal with 80 character/line, upper/lower case and separate numerical and cursor keypads. Price $1595.

Model 3101 with added line editing, block mode and function keys. Price $1995.

High Speed Line Printer Model 3703 speed is 180 cps, bi-directional with 132 column width and tractor feed. Price $2995.

MANY OPTIONS AVAILABLE

We'll help you design your computer system to suit your special applications for:

- Business/Accounting
- Word Processing
- Data-Based Management
- Science and Engineering
- Legal or Medical
- Education

EXTENSIVE SOFTWARE SUPPORT

All current software developed by Cromemco works for The SYSTEM THREE Computer, including:

- FORTRAN IV
- 16K Z-80 BASIC
- Z-80 Macro Assembler and Linking loader

with more on the way.

COMPLETE SYSTEM

With your choice of peripherals, whether they're from Cromemco or from any of the fine devices we have in stock, you can have a microcomputer system up and running, performing a wide range of tasks, for less than $10,000.

*Special pricing available with full system purchase. **Sunshine Computer Company** specializes in assembled systems. All systems are sold with a 90-day written warranty. Stop in for a demonstration. If you're not nearby, call or write for more information, because **Sunshine Computer Company** ships anywhere in the U.S.

Sunshine Computer Company

20710 South Leapwood Ave. • Carson, California 90746 • (213) 327-2118

S-100 Light Pen and Interface Board

Sunset Technologies introduces a low-cost professional quality light pen and plug compatible S-100 interface board usable with any video board. The anodyzed aluminum light pen, connected to the board by super flexible ribbon cable, is controlled by a momentary push button mounted on the pen.

This high quality unit has a variety of applications: program development, text editing, and graphics, to name a few. The complete package includes the light pen and pc board fully assembled and tested, a user's manual with full documentation, and suggested applications. Single quantity price is $250.00 with dealer discounts available. For more information contact Sunset Technologies, 210 A E. Ortega St., Santa Barbara, CA 93103.

CIRCLE INQUIRY NO. 123

Cassette Program Storage

This complete tape-drive unit provides full remote signal control of all transport functions. It includes read/write electronics, control and timing logic, and motor control logic. All you need to supply is a mounting location, power supply and an interface with the controlling I/O devices.

OEMs will find the STR™-150 to be a cost-effective solution to data and/or program storage and retrieval requirements in system applications. The unit is designed for use with micro and minicomputers, controllers, and other devices requiring remote control of the tape drive. The recorder accepts any asynchronous 8-bit parallel data word and records in a self-clocked serial mode.

For further information contact Triple I, 4605 N. Stiles, Oklahoma City, OK 73118, (405) 521-9000.

CIRCLE INQUIRY NO. 132

ACT-IV Microprocessor-Based Smart Terminal

The ACT-IV computer terminal employs an internal microprocessor to achieve smart terminal features at a dumb terminal price.

Standard features of the ACT-IV include an 80 by 24 display format of upper and descending lower case characters, programmable control character display and programmable half or full intensity. The keyboard offers the convenience of separate keys for cursor motion and a SEND key to initiate block transmission.

The ACT-IV can be purchased in either of two packages. The ACT-IV A is housed in a compact cabinet, requires an external video monitor and sells for $550. The ACT-IV B with a high resolution 12-inch CRT and a numeric keypad in its cabinet and sells for $800.

Direct further inquiries to Micro-Term, Inc., P.O. Box 9387, St. Louis, MO 63117, (314) 645-3656.

CIRCLE INQUIRY NO. 140

Advent Computer Interface

The Advent Computer Interface connects an IBM 3270 series computer terminal to a modified VideoBeam® 1000A video projector, enabling it to display on its 7-foot diagonal screen the same image the 3270 displays on its 14" screen. This 7-foot display permits a classroom-size audience to see clearly the alphanumerics generated by the IBM 3270 terminal.

The modified VideoBeam television can also display normal (color and black & white) television signals from off-air broadcasts (with its built-in VHF/UHF tuner), video tape or disk players, video cameras, etc.

Preliminary pricing for the computer display system, installed (f.o.b. Cambridge, MA) is $4,495 for the Model 3270 Computer Interface, and $4,495 for the Model 1000A VideoBeam television (projector and screen), modified for computer display.

For more information contact Marjie Kargman, Advent Corp., 195 Albany St., Cambridge, MA 02139, (617) 661-9500.

CIRCLE INQUIRY NO. 145

The Writehander™

A new typing keyboard has been designed that permits typing all 128 characters of the ASCII code with one hand.

The new keyboard is particularly useful with computers and terminals that accept ASCII-coded parallel input. Using the keyboard with one hand, the operator can hold a telephone or papers with the other.

The keyboard is also useful for those with an injured or disabled hand, to whom conventional typing is impractical.

The Writehander connects to the terminal through a ribbon cable that has lines for the 7-bit ASCII code, a 1-bit fixed parity, Strobe and Acknowledge signals, and the power and common lines.

Price of the Writehander is $98. Delivery is from stock to 15 days. For more information contact Mr. Sid Owen, Newo Company, 246 Walter Hays Dr., Palo Alto, CA 94303, (415) 321-7979.

CIRCLE INQUIRY NO. 143

Master Calendar of Meetings in the Information Processing Field

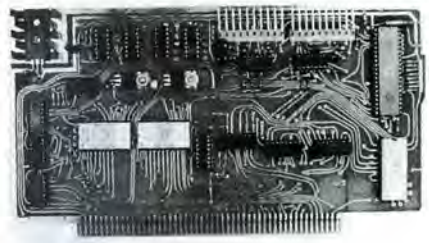
A master calendar of meetings scheduled in the computing and information processing field has been published by the American Federation of Information Processing Societies, Inc. (AFIPS). The calendar provides a comprehensive listing of meetings sponsored by AFIPS constituent societies as well as meetings sponsored by established groups involved in computer science and information processing. The first issue covers meetings scheduled from 1978 to 1981. Complimentary copies may be obtained by contacting Diane Stellingwerf, Editor, AFIPS Master Calendar, AFIPS, 210 Summit Ave., Montvale, NJ 07645.

The calendar will be updated on a quarterly basis with the second edition scheduled for publication in April 1978. Societies, associations, organizations and groups active in the computing field are urged to send information on their meetings for inclusion in the April edition. All material should be sent to the AFIPS Master Calendar Editor.

CIRCLE INQUIRY NO. 138

2SIO® Rev. 8

Monitor ROM and multiple I/O ports on this board make your S100 bus system a turn on and go computer. Controls the terminal and one or two recorders from the on board ROM. 1K of 2708 EPROM is provided. A socket for a second ROM can be used to expand the monitor system.



ROMs can be custom tailored to fit individual user requirements. New ROM programs and the use of EPROMs increase the versatility for the user.

For more information contact Harold Walker, National Multiplex Corp., 3474 Rand Ave., P.O. Box 288, S. Plainfield, NJ 07080, (201) 561-3600.

CIRCLE INQUIRY NO. 146

RS-232C Fiberoptic Duplex Data Link

A complete, full duplex, asynchronous RS-232C Data Link engineered for computer applications is designed for users with little or no experience with fiberoptics. The data link accepts the 25-pin RS-232C electrical plug as input and converts directly to optical digital data transmission. The output is connected directly to pre-terminated fiberoptic duplex cable.

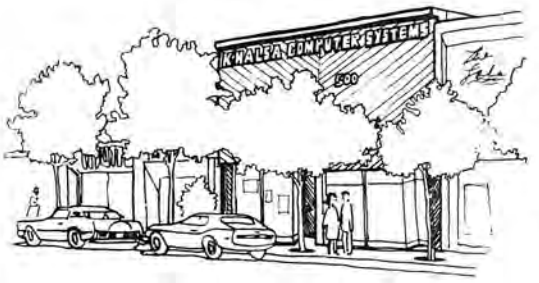
Each end of the link contains a receiver, transmitter, power supply and power cord with wall plug. There is nothing else to buy.

The link and terminated cables are available from Valtec with a 4-6 week delivery. Prices are in the $1000 range for a link pair plus cable costs of approximately $1.00 per foot. For more information contact Valtec Corp., West Boylston, MA 01583, (617) 835-6082, J. Morris Weinberg.

CIRCLE INQUIRY NO. 144

Seeing Is Believing

Khalsa Computer Systems, Inc.
A Professional Approach



Everyone can benefit from owning a computer, especially the business person. But how can you find the computer that fits your needs? You can shop around, or you can come to Khalsa Computer Systems, Inc. We are a dealership for many manufacturers. We select and stock what we believe to be the finest computer systems in every low cost category. Our staff is ready to discuss your exact requirements, and help you sort out all the alternatives, including leasing arrangements.

Our showroom offers you the opportunity to see the various computer systems in a calm and comfortable environment where the emphasis is on effective demonstration and education. Our friendly staff is trained to help you evaluate and configure computer systems that will solve your immediate problems and still allow for future expansion. In our showroom we provide separate booths for each computer system, plus reference books, periodicals, a classroom, lounge, and an office oriented demonstration area.

The selection of computers on display at Khalsa Computer Systems, Inc. represents the best low cost systems available regardless of manufacturer. We've done the research that guarantees you top quality hardware and software based on up-to-date technology. Our systems offer you low cost entry at four figures, yet give you more capability and flexibility than many larger systems offer for tens of thousands of dollars more. For instance, we can supply a complete multi-user timesharing system for under $10,000!

Our software group consists of experienced systems analysts and programmers who know how to solve your data processing problems. We provide services ranging from simple modifications of existing software to complete design and implementation of major software systems.

Our service department offers advanced, efficient service to meet the needs of our clients. We are proud of our new expanded shop and the skilled technicians who can answer the most technical questions about the equipment we sell. They are a vital part of the after sales support offered by Khalsa Computer Systems, Inc.

Come See Us

SYSTEMS BASED ON: Alpha Micro System AM 100, Poly 8813, Industrial Microsystems, Cromemco Z2D System 1, Processor Technology Sol 20, Imsai 8080, 8085 Systems, Vector Graphic, TEI. **DISC SYSTEMS:** PerSci, Calcomp Trident 50 MB-300MB, Shugart, iCOM, Micropolis, North Star, Industrial Microsystems, Cromemco. **PRINTERS AND TELEPRINTERS:** Texas Instruments Model 810 & Silent 700, Teletype Model 40 & 43, Centronics Model 761 & 799, Diablo 1620 & 1610, Microdata Matrix. **CRT TERMINALS:** Lear Siegler ADM 3A, Hazeltine 1500, Adds Regent 100 & 200, Soroc IQ-120, Textronics Graphic & Alphanumeric. **MEMORY BOARDS:** Industrial Microsystems 8K, 16K, Dynabyte, Processor Tech 16K, Extensys 64K, Ithaca Audio 8K Bare Boards. **SOFTWARE:** Microsoft Basic 4.4: Fortran, Digital Research CP/M & MAC, Structured Systems QSort General Ledger, Shrayer: Electric Pencil, BSL Vol. I-VII. Osborne Basic Prog. Discs. CP/M User's Group Collection.

KHALSA
COMPUTER SYSTEMS INCORPORATED

500 South Lake Avenue, Pasadena (213) 684-3311

Tuesday - Friday 12 noon to 8 pm, Saturday 12 noon to 6 pm, Closed Sunday and Monday

Khalsa Computer Systems, Inc. has also been known as the Byte Shop of Pasadena since we opened in 1976

MKB-2 Keyboard

The new MKB-2 Keyboard, designed for use with the new 64 and 80 character display video boards, combines the most popular keyboard features with a low, affordable price.

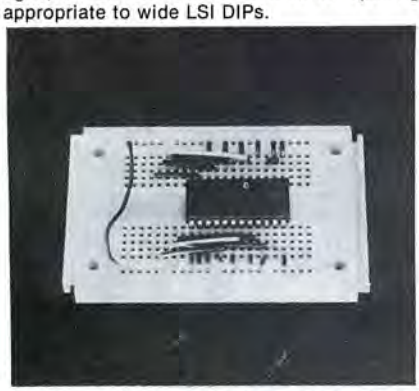
Included as standard in the MKB-2 are a numeric keypad, upper and lower case, cursor control keys, 2-key rollover, and auto repeat. Plus, the MKB-2 is assembled in a heavy-duty steel case with parallel interface, strobe or pulse, on-board voltage regulation (5v or 12v), complete with standard DB 25S connector, white on black double injection molded keys.

The MKB-2 retails for $149. It is available through MicroAge Mail Order. To order, or for more information, contat MicroAge Mail Order, 803 N. Scottsdale Rd., Tempe, AZ 85281.

CIRCLE INQUIRY NO. 142

CSC Small Experimentor™ Sockets EXP350 and EXP650

The palm-size EXP350 and EXP650 each measure just 3.6" long. The EXP350 offers .3" center spacing to accept standard DIP packages; the EXP650 offers the wide .6" spacing appropriate to wide LSI DIPs.



Their small size offers the opportunity for bite-size modularity — byte-size, in many applications. This can happen in several ways.

For one, a complex LSI function IC like a UART can be accommodated, along with pertinent support discretes and connecting cables as a module on a CSC EXP650.

Or an LSI function can be synthesized with less complex circuitry. A counter, decoder and display, for example, can be combined on a single EXP350 and treated as a unit — as can a data converter, an interface circuit, or any of a number of functional modules.

The EXP350 single unit price is $5.50; the EXP650, $6.25. For additional information contact Continental Specialties Corp., 70 Fulton Ter., New Haven, CT 06509, (203) 624-3103.

CIRCLE INQUIRY NO. 159

ABC 1500 Kit Reduced to $89.95

Prices have been reduced more than 50% on the Adaptable Board Computer (ABC 1500) kit, a complete 8-bit microcomputer.

The system can be used as a prototyping or system development tool for microprocessor-based systems. The ABC 1500 allows a user to configure an accurate prototype with a minimum of design effort.

The ABC system is available in either card form or as a kti. The card, which is completely assembled and teste)d, is now priced at $149 in unit quantities, reduced from $275. The kit, which comes unassembled with with all necessary ICs, resistors, capacitors, and other components and hardware is now priced at $89.95, down from $190.

Additional memory or control features, unique input/output circuits and the like, can be added by connecting selected components to the existing circuitry with jumper wires or wirewrap connections. Room for new components is amply provided on the board, with plated through holes in place. All jumper-selectable options can be changed after a prototyping task is completed to configure the board to an entirely new system.

Both card and kit versions are available from stock through Signetics and its authorized distributors. For further information contact Signetics, 811 E. Arques Ave., Sunnyvale, CA 94086, (408) 739-7700.

CIRCLE INQUIRY NO. 141

New Fram/Autolite Customer Order Processing System Provides Greater Speed and Accuracy

Fram Corporation has installed a computerized order entry system which provides the capability for warehouse distributors to enter orders automatically without error, and to immediately analyze dollar value and weight of orders for maximum freight and discount benefits.

The order entry system has been named "COPS," an acronym for Customer Order Processing Service. It utilizes a teleprocessing device at the customer location, connected with Fram computer facilities at Providence, Rhode Island, through the General Electric communications network.

The "COPS" system is compatible with other computer order entry systems, specifically the Bendix "BOSS" system and the "Transnet" system. Any distributor utilizing either of those systems can immediatley place orders with Fram by calling the "COPS" administrator at (401) 434-7000. Distributors not equipped with other systems can arrange for use of Fram's order entry system by contacting the "COPS" administrator for details. Fram Corporation, Providence, Rhode Island 02916.

CIRCLE INQUIRY NO. 156

MPS-3000

The Model MPS-3000, a new miniature modular microprocessor power supply, is designed specifically for minimum Intel 8080 microprocessor systems.

This supply was designed to meet the power needs of the small dedicated 8080 microprocessor system in rugged commercial and industrial applications where environmental protection is desired.

All three supplies contained in the MPS-3000 are protected against short circuits by foldback current limiting. The supply is designed for an operating temperature range of 0°C to 70°C.

The MPS-3000 is priced at $95.00 each in single quantities and at $62.00 each at 100 pieces. Delivery is from stock for 115VAC, 220VAC or 100VAC operation.

For details and literature contact Steve Cuff, Marketing Manager, Calex Mfg. Co., Inc., 3305 Vincent Rd., Pleasant Hill, CA 94523, (415) 932-3911.

CIRCLE INQUIRY NO. 157

Quadruple Output Switching Power Supply

Gould's MGQ-300 is one unit offering four independent switching power supplies. The device offers higher efficiency and flexibility than similar units already on the market.

The MGQ-300 features isolated outputs of +5V 30A, -5V 5A, and ±15V 2A. Overvoltage and current protection are provided on all outputs. The supply will withstand continuous short circuit conditions on any or all outputs.

The temperature range of the MGQ-300 is -10°C to +70°C with a 2.5 percent per °C derating from 50°C at full output.

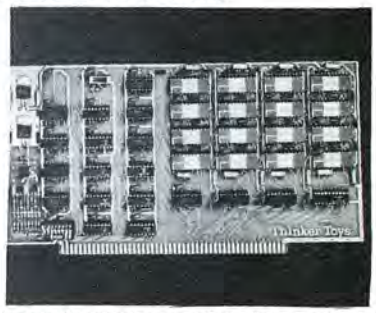
All outputs will remain within voltage regulation at full load for 28mS after the removal of nominal line voltage.

For further technical and pricing information contact Gould, Inc., Electronic Components Div., 4601 N. Arden Dr., El Monte, CA 91731, (213) 442-7755.

CIRCLE INQUIRY NO. 155

New Dynamic Memory

The new refresh design, named Synchro-Fresh™, is much simpler than previous approaches and totaly reliable.



Using SynchroFresh refreshing circuitry, the new 8K memories use half the power of static boards, and can undersell both static and older design dynamic memories by considerable margin.

The Thinker Toy "ECONORAM III 8K with SynchroFresh" is supplied as part of The Equinox™ personal computer system. The board will be supplied by Godbout Electronics, and is available by direct mail from Thinker Toys™. ECONORAM III will also be available through local computer shops. For more information contact Thinker Toys, 1201 10th St., Berkeley, CA 94710, (415) 527-7548.

CIRCLE INQUIRY NO. 149

S-100 Bus Interface

HUH Electronic Music Productions has the PET'S 100 — a PET to S-100 Bus interface board. This S-100 sized card plugs into the mainframe of your choice and a cable connects it to your PET which then enables you to use the wise range of peripheral and memory cards available for the S-100 bus. The PET'S 100 is unique in that it emulates the true S-100 bus including DMA, both read and write wait states, I/O address mirroring, multiplexed status lines and much more. This means you can use Dazzlers, Bytesavers, slow memory (like 1702s) analog interface and a whole host of other tricky cards.

The PET'S 100 will be available in kit or assembled form for $199.95 or $279.95 respectively, but a special introductory price is being offered to those placing pre-paid orders before March 31st, 1978. This special offer is good for the kit version only and is $169.95. Deliveries are scheduled to begin in April.

Come to the 3nd West Coast Computer Faire and see it running in Booth M-1. You may also place your order at the Faire.

Dealer discounts are available. For more information contact HUH Electronic Music Productions, P.O. Box 259, Fairfax, CA 94930, (415) 457-7598.

CIRCLE INQUIRY NO. 226

Turnkey Minicomputer Client Writeup System

Version 5B of GIS-ABLE is a turnkey minicomputer financial control system for accountants and corporate financial officers.

The present version of ABLE features a complete hardware and software general ledger package designed for use on PDP-11 series minicomputers. The system is expandable to 64 CRT terminals. ABLE Version 5B operates in single job or timesharing modes.

ABLE is an interactive system capable of generating a full range of reports, journals and ledgers. Program flexibility permits completely individualized reports derived from any chart of accounts. Based on user needs, reports can be generated in dollars as well as non-monetary readouts such as gallons of gasoline, or product units, or telephone calls. Payroll recording and analysis also can be performed separately, or an an integral part of ledger posting.

For more information on ABLE, contact General Information Systems, Inc., 2024 N. Broadway, Santa Ana, CA 92706, (714) 834-0230.

CIRCLE INQUIRY NO. 336

IAS Operating System for PDP-11s

Digital Equipment Corporation has an enhanced version of its Interactive Application System (IAS) operating software for large PDP-11 systems. IAS Version 2 is designed to support up to 32 interactive users, as well as additional peripheral equipment and software options.

IAS Version 2 is currently available for distribution to present users of PDP-11/45, PDP-11/60 and PDP-11/70 systems, or for delivery with new systems. The single-system license fee with full support is $17,160. For more information contact Digital Equipment Corp., Maynard, MA 01754, (617) 493-2857, McLaren Harris.

CIRCLE INQUIRY NO. 343

CP/M™ Macro Assembler (MAC)

A macro assembler, called "MAC," operates with the Digital Research standard CP/M Diskette Operating System and implements the redefined Intel standard macro facility, while retaining upward compatibility from previous standard assemblers.

Documentation includes the "MAC Macro Assembler Language Manual and Applications Guide," which is a complete text on the use of macro facilities for microcomputer software design. Applicable to both the Digital Research and Intel macro assemblers, this manual contains several complete examples of microcomputer applications, including traffic light and machine tool control, machine instruction emulation, program control structures, and operating systems interfacing for data file management (170 pages).

The diskette containing the macro assembler (machine code only) is available with the documentation for immediate delivery at the price of $70 (diskette order must be accompanies by the purchaser's CP/M serial number). The documentation is available separately for $15 (no serial number required), with the option of later diskette purchase at $60. For more information contact Digital Research, P.O. Box 579, Pacific Grove, CA 93950, (408) 373-3403.

CIRCLE INQUIRY NO. 337

Fully Static 64K ROM — in VMOS

American Microsystems, Inc. (AMI) has fabricated a 64K ROM with the new VMOS technology.

Designated the S4264, the 8K x 8 ROM yields substantial cost reductions by reducing the number of parts required, simplifying printed circuit boards and eliminating the need for clock signals to the ROM. In addition, the S4264 offers a maximum access time of 350 nanoseconds and reduces power requirements to only 145 milliwatts maximum for the 65,536 bit chip.

The 64K ROM is contained in a 24-pin package and requires a single socket to replace four 16K ROMs in existing designs for display terminals, plug-in computer language modules and numerous control applications in, for example, video games or industrial controls.

Evaluation products are available. Prices are negotiated on the basis of quantities ordered, but will be about $50.00 in quantities of 500. Send product and literature inquiries to American Microsystems, Inc., 3800 Homestead Rd., Santa Clara, CA 95051, (408) 246-0330.

CIRCLE INQUIRY NO. 234

Multi-Protocol Serial I/O Circuit

Zilog, Inc., has a high-speed, dual-channel, multi-protocol serial data communications controller circuit — the single-chip Z80-SIO — for advanced LSI microcomputer systems.

The serial input/output controller, an N/MOS 40-pin device, is a multi-function peripheral component that can control communications peripherals and format data in data communications networks.

Designed to work with Zilog's Z80 microcomputer family and also easy to interface with most other 8-bit and 16-bit processors, the Z80-SIO supports the "Daisy Chain" interrupt structure of the Z80-CPU for fast, powerful interrupt processing with no added hardware overhead.

Pricing for the Z80-SIO in small quantities is $54 in a 40-pin ceramic package and $49 in a 40-pin plastic DIP. Delivery is off the shelf. For detailed information contact Zilog, 10460 Bubb Rd., Cupertino, CA 95014, (408) 446-4666.

CIRCLE INQUIRY NO. 225

"Pad-Per-Hole" Boards

A family of large-area "pad-per-hole" plugboards permit convenient breadboarding of either custom circuits or S-100 bus compatible boards.

All boards have an isolated array of square solder pads surrounding 0.1 inch spaced holes. The 45P80-1 has a mounting area of 36.36 square inches, and the 106P106-1 has a mounting area of 112.36 square inches. Both boards are fabricated without card edge connectors and may be cut to any desired shape.

The third, designated the Model 8801, is form and fit compatible with the S-100 bus system, accommodates DIP devices, modules and discrete components necessary for microprocessor cpu, memory, and interface circuits.

The Model 8801 board is priced at $19.95 each, the 45P80-1 is priced at $9.96 each and the 106P106-1 is priced at $18.99 each. Quantity discounts are available and delivery is from stock. For more information contact Vector Electronic Co., Inc., 12460 Gladstone Ave., Sylmar, CA 91342, (213) 365-9661.

CIRCLE INQUIRY NO. 296

Printed Circuit Test Jack

This horizontal test jack is designed as a low-profile, double-entry industry standard printed circuit test jack and meets MIL-C-39024/11.

Dense packaging on .160 centers is possible because of the low profile and narrow width. These test jacks have a rugged molded nylon housing in various standard colors, and tough "hour glass" designed beryllium copper contacts of various finishes and printed circuit tail lengths. The double-entry design permits probe insertion from either end. An internal closed entry feature prevents the insertion of oversized probes.

For more information contact Eby Co., 4701 Germantown Ave., Philadelphia, PA 19144, (215) 842-3000.

CIRCLE INQUIRY NO. 289

BOOK REVIEWS

GETTING INVOLVED WITH YOUR OWN COMPUTER A Guide for Beginners

By Leslie Solomon and Stanley Veit
Ridley Enslow Publishers

Review by Barbara R. Schwartz

Until now, most computer books have been for the commercial market, people involved in data processing using computers at their workplace or school. Now, however, with the advent of the affordable home computer, a definite market exists for a computer book written for the hobbyist. *Getting Involved With Your Own Computer* fills this need and does it quite well.

The book starts out with an introduction that describes the history of computing devices, such as the abacus, the pocket calculator, and the development of the microprocessor. The first chapter is written to inspire the reader to read the rest of the book, by describing various uses of a personal computer.

The second chapter describes sources of information on computers, including magazines, books, catalogs, clubs and computer stores.

The third chapter, entitled "How to Communicate with a Computer," is an introduction to the understanding of binary, decimal, octal and hexadecimal numbering systems.

The next chapter goes on to describe the five basic parts of a computer: The central processing unit (CPU); the memory, which stores computer programs and the results of calculations; the input/output (I/O) through which data enter and leave the computer; the clock, which causes things to happen in sequence; and the power supply, which provides the direct current to the computer.

This chapter further elaborates on these parts of the system, and includes a short discussion of how the elements are added together in the system. A simple discussion follows, describing the bus structures. The discussion then proceeds to various systems modules, such as audio cassette storage, video interface boards and I/O boards, and floppy disks.

The fifth chapter, "Thanks for the Memory," covers various kinds of memory and defines the two basic types of memory used by a hobbyist, RAM or random access memory, (which remembers the data only while the power is on), and ROM, read only memory whose data is not lost when the power is off. Further descriptions are given of forms of mass storage such as disk and tape.

After covering the basic types of computers and memory, the book then moves on to what must be one of your first concerns, "What Kind of Equipment Should You Start With?" The book describes various teaching type machines, such as training devices, the CARDIAC, a cardboard gadget which supposedly simulates a computer; the Ohio Scientific Model 300 Trainer; the Texas Instruments Microprocessor Learning Module System, and the Isasis Ia 7301 Computer in a Book. The chapter then goes on to discuss evaluation kits, one board computers, and mainframe computers. Attention is also given on what to buy, and some hints on kit building are included.

The next four chapters describe some common computers which you might be considering buying. Chapter 7 describes the Altair, IMSAI and other machines using the S-100 bus. Chapter 8 discusses various 6800 systems, including the Southwest Technical Products Corporation 6800 and the Altair 680b. Chapter 9 discusses the products of The Digital Group, and Chapter 10 discusses other computers that you might want to look at before making your final decision, such as the Apple 1, PET (Personal Electronics Transactor) by Commodore Business Machines, and several others. This section is fairly up to date, but such recent computers as the Heathkit line are not covered.

The next chapter discusses peripherals and input/output devices and introduces the functions of the UART, (Universal Asynchronous Receiver Transmitter), which is used for converting data from parallel to serial form (and vice versa).

Chapter 12 discusses the various types of software available for your home computer, including machine language, assembly language, and higher level languages such as BASIC.

The final chapter is an expanded version of the material at the front of the book on uses for your own personal computer. The various appendices cover the abacus, the Altair S-100 bus, ASCII code, "The Care and Feeding of Your Computer," and "What Do You Do When Something Goes Wrong?"

On the whole, I think this book is a worthwhile addition to the computing literature and it is especially to be noted for being as updated as any book can be, considering the fast changing nature of the field. The basic information is presented quite clearly, and on the whole, I think that Veit and Solomon have done an excellent job. I can certainly recommend the purchase of the book for any novice.

BASIC

By Samuel L. Marateck
The Courante Institute of Mathematical Sciences, New York University, Academic Press

Review by Barbara R. Schwartz

Marateck's *BASIC* is one of the better introductory texts on the BASIC language, currently the most common higher level language for personal computer users.

The one drawback of the book for such users is that it was designed for the user of a GE, DEC(PDP), CDC or Univac computer with footnotes describing the differences for such computers as the Hewlett-Packard 2000 series or the XDS Sigma series, IBM 360, IBM 370 or CDC 6600 computers. Therefore, the systems commands, and the actual BASIC language itself might be different for the computer that you are using. So, this book must be read in conjunction with your own system manual to be of use to you. Still, the quality of the presentation of BASIC is such that this book can be heartily recommended for purchase, despite the occasional conversion problem that you may have in running these programs on your computer.

The book is basically divided into two parts. On each set of pages, the right page contains one or several small programs, or tables, what Marateck calls pictures. Marateck follows the rule of generally adding

only one new concept in each program, so the programs illustrated are generally fairly small. The left hand page of each pair contains a greatly amplified discussion of the picture page and is especially useful for first time programmers. Indeed, if you have previous experience in BASIC or any other programming language, you can get a fairly good introduction to BASIC by reading only the picture pages in conjunction with a computer, or even without a computer. When I first read this book, I only skimmed through the picture pages, so I can assure you that this can be done.

Another example of how this book has been designed to be helpful is that words underlined in the captions describe lines underlined in the figures on the picture page.

There are problems at the end of each chapter, generally asking the reader to write programs or figure out what the results of a given program will be. After running the picture programs on your computer, you are thus given a chance to write your own programs or check out ideas on how a given program will work.

The book generally covered just about all the BASIC you will need to know. It starts out by covering PRINT and assignment statements, and then moves on to cover the READ, DATA, GO TO, IF and INPUT statements. Further chapters cover the FOR-NEXT loop, strings and library functions. The book also covers such statements as the PRINT USING statement, a formatted output statement, which is not even included in all BASIC languages.

In summary, Marateck's *BASIC* is a well-written introduction to simple BASIC and it is well worth purchasing and performing whatever conversions are necessary to bring your BASIC into line with the version of BASIC used in the book.

SOME COMMON BASIC PROGRAMS

By Lon Poole and Mary Borchers
Adam Osborne & Associates, Inc.
192 pages

Review by Col. E. Wingfield Verner

Some Common Basic Problems contains seventy-six relatively short and easily entered programs of very practical utility. The authors have intelligently utilized a restricted subset of common BASIC statements to allow compatibility with as many versions of BASIC as possible. The liberal use of remarks not only allows the reader to easily follow program flow and to make minor modifications, but provides the neophyte programmer with a valuable learning tool.

Reading through the index will impress the prospective purchaser with the wide variety of supplied programs. Areas covered include finance, statistics, vectors, matrix manipulations, regressions, equation solutions, numerical integration and differentiation, permutations and combinations, and the plotting of both rectangular and polar coordinates.

This writer has personally used a considerable number of these programs in a small college system and views the experience with mixed feelings. A case in point is the anglo to metric conversion program. Sixteen of the seventeen conversions generate wrong answers. As a matter of fact the sample run provided with the program can be seen to give wrong answers by inspection. The fix is simple, but such an obvious fatal error in a straightforward program forces one to feel more than a little apprehensive when using some of the more complex programs for real world application.

The other feature that proved objectionable was the requirement to write specific line numbers prior to running a program. This requirement makes the programs, as written, useless if you have a run package and compiler rather than a less sophisticated interpreter. Even with an interpreter, the computer operator is forced to refer back to the book prior to running a program to determine if a statement is required and if so, how it is to be written. Most of these objections could have been easily eliminated by the simple expedient of utilizing the input command, and forcing the computer to generate the required statements in response to operator input.

In spite of the problems encountered with some of the programs, it is strongly felt that *Some Common Basic Programs* is well worth the purchase price. It represents one of the best software bargains available.

The authors are to be commended for their efforts in helping to fill the software void for the small system user. A little more effort expended in program debugging and in eliminating the unwieldly run requirements should assure the success of any future releases.

USER'S MANUAL FOR LEVEL 1 RADIO SHACK TRS-80 MICRO COMPUTER SYSTEM

By David A. Lien
Radio Shack, Ft. Worth, TX, 1977

Review by Don M.M. Booker

Terrible name for a great book. This should be called *Fun BASIC.* The author's note claims "this is not a conventional book." For a change, that's a claim truly made. While he signs in as Dr. David A. Lien, don't hold it against him. In an effort to make this book easy to read, and easy to enjoy, he has used "every fair and unfair, conventional and unconventional, flamboyant and ridiculous technique" he could think of — mostly lots of bad jokes, and quick apologies for the introduction of anything that even vaguely smacks of jargon. (There is still enough to impress your friends, so don't worry.)

The author's aim is to make learning BASIC fun and I think he has succeeded. He suggests that you "sit back and relax and read slowly as though savoring a good novel;" well, I like to read fast-paced novels and rip through them at break-neck speed. And you can do that with this one. It is a little short on plot, but if you are the type that likes to read books and magazines from the back forwards (as I am), then this is the book for you. Typical of the style is the "Note on Using the Recorder" on page 5: "Some of this will be covered in greater detail in Chapter 9 . . . but some of you can't wait till then . . . *can you!*" (author's emphasis).

An "interactive" tone pervades the entire book. You get the feeling that Dave (and you feel it is Dave, not Dr. Lien) is talking with you, not down at you. This approach is helped by a layout that is a modified programmed instruction format. The use of blocked grey backgrounds and two "pages" per page allows a clear emphasis of what might otherwise be vague points. But more importantly, it helps to sustain a conversational tone, with the extra emphasis, (reinforcements), feeling more like a normal conversational aside that transmits enthusiasm, rather than the usual P.I. "bell and shock" approach.

Not only the layout, but the presentation has the best of the P.I. approach, without its boring qualities. The material is clearly broken down into bite-sized pieces and sand-

wiched with plenty of natural examples and sample problems which flow along with the narrative without the usual tacked-on "here's a problem you solve" feeling. There are clear working solutions provided — 22 pages of them — and the humor (?) helps rather than detracts.

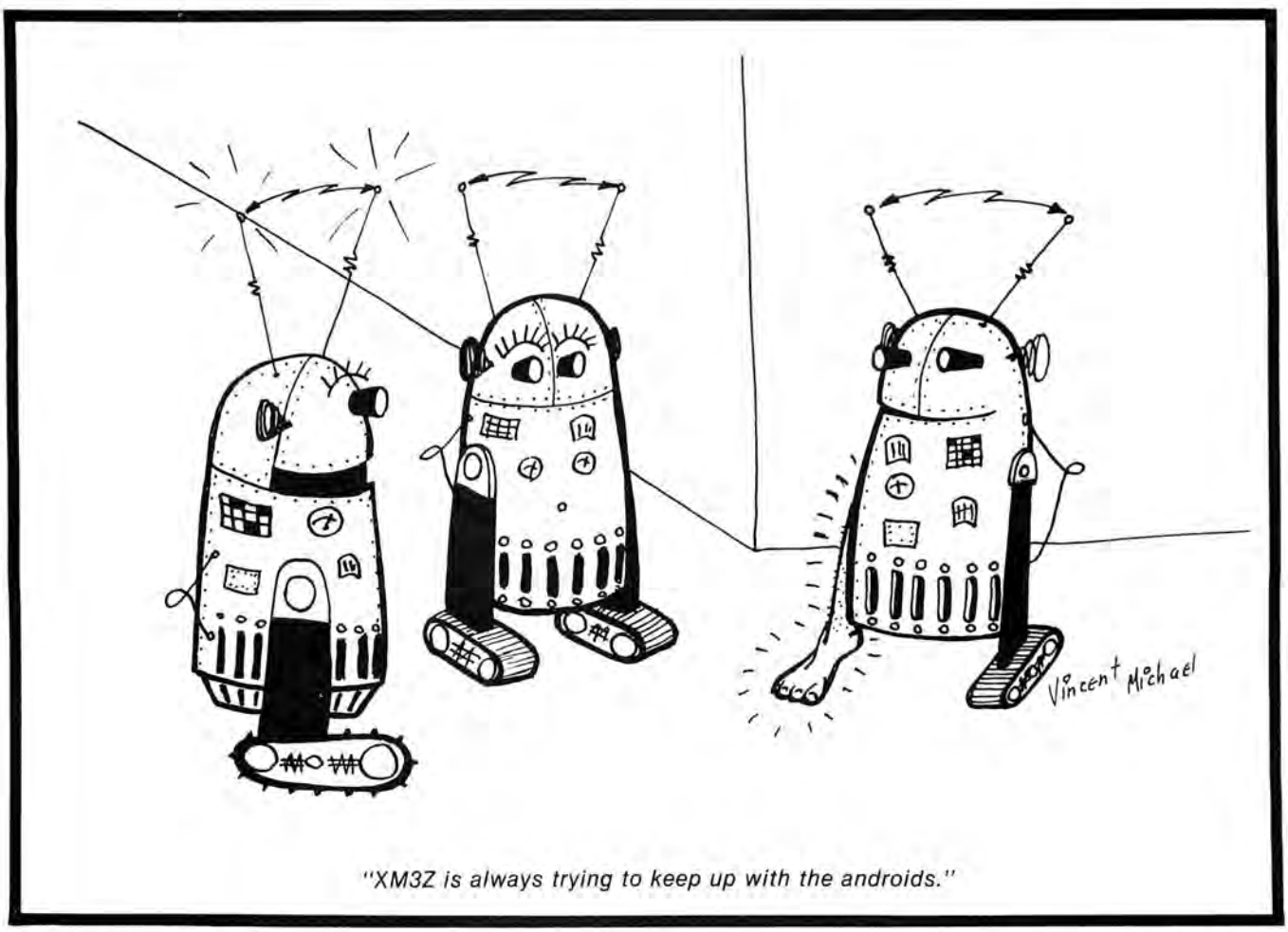
This "we are solving a problem" sense is immeasurably aided by the manual's complete tie-in (naturally) with the TRS-80. While I would recommend this book to anyone wanting a painless introduction to BASIC, I would also practically force them to use a TRS-80 with it: not because, as is the case with most other books on BASIC, it is almost required, but because you would miss all the fun if you do not have a handy TRS-80. The problem with most texts on BASIC (from an old hand's point of view) is that the reader cannot be *sure* that what the book says will happen, will actually happen in the computer he is using, exactly the way the book describes it; not almost, or sometimes, but *always* and *exactly that way*. When you can be sure the computer you are using will tie in with the book exactly, it means you can learn from the beginning that a computer does what you tell it and not the other way around.

The first program on page 8 may not excite you automata theorists and robotics experts, but if it is the first program you have ever written, I am sure it is just as much fun and probably more exciting than the usual "find the square root of x" problem. At least, I would rather have a book that shows me how to teach my computer how to talk to me, even if all it says is "Hello, there. I'm your new TRS-80 microcomputer."

For more sophisticated fun we get TRS-80 graphics commands by Chapter 20, with more advanced graphics in Chapter 22. (That is not as bad as it sounds — each of the 26 chapters averages only 6 pages, with lots of white space and pictures — most of them a slightly anthropomorphic TRS-80.) There is even coverage of modular programming and an excellent final chapter on debugging, which ties in well with a comprehensive Function and ROM test hardware exerciser in Appendix C. This enables and encourages the novice to disabuse him or herself of the habit that "it's got to be in the hardware." There is even some stylish indentation and "structure" in the sample programs to encourage good habits by example, rather than preaching "structured programming" (which, if repeated at 9, 12, and 3, will solve all programming problems).

There is also a selection of sample programs provided in Part C, that cover the usual range of simple games (Slowpoke, Wheel of Fortune, Craps), stock market and personal finance, and limited interest technical (Design Program for a Cubical Quad Antenna) subjects. There is even a poetry program based on "On a Snowy Evening" by Robert Frost. As the author says, "if this one doesn't grab you, nothing will!"

This book definitely does not deserve the "technical manual" connotations that its title implies. A horrible technical manual it is not. As an introduction to BASIC it rates tops. This is because the author's goals are successfully carried out, but more importantly, they are also the goals of the reader. "The real enjoyment begins when your imagination starts the creative juices flowing, and the computer becomes a tool in your own hands. You become its master — not the other way around. At that point, it evolves from just a box of parts into an extension of your personality. Enjoy your new computer!" And enjoy your introduction to communication with your computer in BASIC.



"XM3Z is always trying to keep up with the androids."

SOFTWARE EDITORIAL

By A. A. Perez, Software Editor

THE IMPORTANCE OF SOFTWARE DOCUMENTATION

As you have probably gathered from Carl's editorial, and comments made by myself and readers of the magazine, there is a very definite problem in the understanding of software documentation. Therefore, to help in the understanding of what documentation is, and the correct method(s) of creating it, we are offering this series of documentation editorials.

Last month, the basic phases of a software project were discussed. This month I will present the importance of the supportive documentation, and the types of documentation required.

HARDWARE DOCUMENTATION

In the fabrication of hardware items, several documents are generated called engineering products. These engineering products are used to record the plans and schedules for the execution of various phases of the project, thus ensuring the timely delivery of the items being fabricated.

The most familiar engineering products for hardware fabrication are: The detailed drawing, assembly drawing, and user's manual. These few engineering products allow the experienced hardware engineer to visualize the final finished product. In other words, the hardware engineer has something tangible to work with, even before final assembly.

SOFTWARE DOCUMENTATION

In the software engineering world, there is a need for engineering products similar to that required for hardware engineering. These software engineering products perform the same function as hardware engineering products. That is, they map out the various steps that ensure the timely delivery of the final software product(s).

However, the situation is more complex for software products. This complexity arises from the fact that we are dealing with something that has more than the usual three or four dimensions of length, width, height, and time.

Unfortunately, we are not yet at the stage in software engineering to say that some system constant, (parameter), will not vary with time. The so-called non-varying constants of software, if any, are only familiar to software and computer scientists who specialize in analyzing software and information handling techniques.

What is being alluded to is that, due to the complex nature and varying working environments of software, you don't have a program or viable software without the associated documentation. As the old saying goes, "without the documentation, the program is useless." The documentation is important since it defines the parts of the program in relationship to the working environment, and how the program changes with time.

What happens to hardware is more familiar to the human user than what happens to a piece of software. With hardware we are dealing with a tangible item. With software we are dealing with a tangible piece of information which changes its behavior with time and environment. Unless we keep track of the history of the environment to which a piece of code is subjected to, the relation of the original to the subsequent code is, at best, difficult to correlate. At worst, some unexpected behavior of the environment happens, and after that we really have a problem of addressing what *could have happened* to the original software.

CONFIGURATION MANAGEMENT

The engineering multidiscipline of software configuration management, if adequately set up from the beginning of the software project, can be very helpful because it attempts to identify, account, and control all changes to the subject software. Even for a one-man software engineering house, configuration management techniques can be very helpful. But as in every good thing to have, it costs resources to maintain a software configuration management activity. Good documentation is the basic staple of software configuration management (*S/W, C/M*). There are many types of documentation that the operator of the *S/W, C/M* activity needs to start and maintain. The variety of documents depends on the *phase* and *size* fo the software engineering project.

Keep in mind that it costs resources, (financial and personal), to initiate and maintain a software configuration management organization. However, for a fairly large software project, to avoid the pitfalls and headaches which develop out of dealings with a smart customer, the cost of resources for software configuration management is well worth the investment.

Another bonus that comes with good documentation, on which *S/W, C/M* depends, is the ease with which new personnel to the software project can catch up to become productive. For example, using the HIPO documentation technique described by Tom Fay in this issue, I managed to understand, in a little more than two weeks, the structure and operation of a quarter-million instruction real time operating system for a large space system software project.

SOFTWARE DOCUMENTS AND THEIR DESIGN

Some of the documents required in a software engi-

neering project are listed below. The documents that are initiated and maintained depends on the personal judgement of the software project engineer.

Development Specification establishes the requirements for performance, design, test, and qualification of a comptuer program. This is the major section of the system's program development specifications. It shall consist of a series of paragraphs which specify in detail the performance requirements, design constraints of standards to ensure proper development of the computer program. It shall further establish the requirements which normally will be verified during category I, equivalent tests.

Requirements will be specified to the level of detail necessary to establish limits of design. Quantitative requirements shall be within three principal subparagraphs.

Product Specification; this document establishes the requirements for complete identification of the program, to be formally accepted by the procuring activity. This will include a brief review of the major functions of the complete program. The *development specifications,* compared to the product specifications, seem to list all the features which the inspired design would like to consider nice to have. The *product specifications* set down the practical things that may be implemented and delivered.

Interface Specifications are designed to bring together, into a single document, all available data and interfaces between operational programmers. This document also defines the environment of the computer program.

Validation Test Plan; the extent of this document shall be governed by the tests, requirements and acceptance criteria defined in the application *development specifications.* It shall specify the method and content for each product test activity. The *validation test plan* shall define the detailed design requirements and shall contain, to the extent applicable, the specific types of information for the level of testing being described.

Test Management; this paragraph shall define the individual detailed responsibilities for conducting and coordinating the given test activity. It shall distinguish between: Contractor responsibilities, other agency responsibilities, and associated supplier responsibilities.

Validation Test Procedure; this document shall be developed from the *validation test plan* and/or *development specifications* test regulations, and shall present detailed instructions for each level of testing specified in the test plan. These procedures are intended for use by personnel responsible for unification of program content and operation, from initiation to completion of program development.

The primary requirements of this document is that it present a complete, well-organized, and unambiguous procedure covering all aspects of operation. The amount of detail necessary to accomplish this varies with the level of testing involved, and must be determined for each particular case. As such, the requirements contained herein are to be considered the minimum acceptable coverage and should not be construed as limiting the scope or degree of detail necessary in a particular document.

Computer Operator's Manual; this document shall present procedures covering pre-standby operation, monitoring, recovery, and maintenance of the computer program. The minimal operational environment shall be described in terms of its component parts. This document shall not include procedures for system operation directly in support of the operational mission. That is, the operator's manual shall be limited to instructions for preparing and maintaining the computer program in the required state of capability, in order that the operational mission may be accomplished.

This complexity arises from the fact that we are dealing with something more than the usual three or four dimensions of length, width, height, and time.

SUMMARY

Program maintenance, program assembling and loading, development test plan, and development test procedures, are other documents which are very important in the operation of a computer to accomplish the intended software project, in a correct manner. However, these are subjects which will be covered in future issues.

Some of these documentation efforts are started and executed during the implementation phases under the title of *validation and verification,* (V&V), and can best be performed by an independent testing and analytical organization. The developers of the system are too close to the day-in-day-out problems. Therefore, it is usually better to get an outside V&V team, (even with the same company), who have a fresh outlook on the problem. I have personally had the pleasure of being invited to be a member of a V&V team, assembled from several divisions of a large corporation, to direct the validation and verification effort on a major real time program which was originally scheduled for a half-dozen flight tests but, as a result of design errors discovered by the V&V team, was reduced to three or four tests.

Next month, I will continue with software documentation by investigating other useful documents and their uses.

For those of you who have a specific question regarding documentation or software development, please write to me at INTERFACE AGE Magazine, P.O. Box 1234, Cerritos, CA 90701. I will either answer you directly or within this editorial. □

Floppy ROM Loading Techniques — Part II

By Orv Balcom

Have you ever noticed that when a guy is good he is very very good? As you read Orv's loading techniques, part two, you will find out what it is like to touch base with an excellent engineer.

In Part I, Orv covered the hardware techniques required to strip data off the Floppy ROM, with the least amount of trouble. This article provides you with error recovery software to make the ROM even more useful.*

—Editor

Alright, all you good buddies out there in computerland, you're right. I did it to you in Part I. I left you hanging worse than 1000 GOTO 1000. In my first article, I mentioned that a single error could crash a whole tape, but gave no hint of what to do about it. I assume the more ingenious of you got together and collected from friends enough good files to make up a complete system. But, what about the poor fellow who is isolated from the rest of the computer people. He has a problem.

This article will tell how to remove that little glitch from the start of your Floppy ROM cassette file so you can recover the remainder of the file. We'll lose one or two lines in the process, but since INTERFACE AGE always provides the source text, it is only a matter of retyping the lost lines to recover the whole file. It sure beats typing in a 20K program. This technique will not recover all tape errors. For the approach to even work, it is necessary that the computer be able to read the first line of the file. This means the computer must be able to read the start byte and sync byte from the Tarbell tape, plus at least one line of BASIC.

I have discussed this problem with Don Tarbell and he tells me that errors can occur from generating additional clock pulses or from missing a clock pulse. An error can also invert the remainder of the code. In my own experience, every error I have noticed in a Tarbell tape (and I've seen a few!) have been characterized by a shifting of the code to the left by one or more bits. This is the type of error we will attempt to correct with the program shown in this article.

A good way to demonstrate this type of error, if you happen to have a computer with output LEDs on the front panel, is to put the input bytes from the tape to the LEDs during a read. When you're reading an ASCII file (without parity, D7 = 0), D7 should be off (on for an IMSAI since its LEDs are inverted). If an error of the type I have described occurs, the off LED (D7) will shift to D0 or possibly D1. As additional errors occur, the off LED will shift across the display from right to left.

Since I know many of you are essentially BASIC programmers, I will explain a few words that will have to be used because this article will deal with problems at the memory image or object code level. First, a bit is the smallest piece of information we will consider. It is equivalent to the output at any instant on a single line of a parallel port or one of the data LEDs. A serial port handles data one bit at a time. A byte consists of 8 bits. These are ordered from most significant (MSB) to least significant (LSB). This is like from D7 to D0 in your data LEDs. The Tarbell interface, which is a serial interface, puts data on the tape MSB first. A word is 2 bytes or 16 bits. It is generally used to describe a memory location (1 out of 65536 possibilities) or represent a decimal integer from 0 to 65535 (or possibly from -32768 to +32767). For this discussion, words are always stored in memory in the Intel format, which is low byte first. In other words (no pun intended), if location MEM and MEM ± 1 contain a 2-byte word, the low (least significant) byte is in MEM and the most significant byte is in MEM + 1. In BASIC, the value at MEM and MEM + 1 would equal PEEK(MEM) + 256*(PEEK(MEM + 1)). Two-bit words are something else again. Hopefully, the editors at INTERFACE AGE will have DELETEd all of them before you read this article.

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LOADING CASSETTE FILES TO MICROSOFT BASIC

If you were slightly disappointed when you typed CLOAD"A" to your brand new $350 Microsoft BASIC and got SYNTAX ERROR, I don't blame you. If you have the CP/M version, this procedure will let you convert MITS files to Microsoft CP/M BASIC files.

1. Load the cassette file as a memory image at 0100 HEX (the start of your TPA).
2. Boot up CP/M and save the program as a .COM file, i.e. SAVE XX filename .COM where XX is the number of 256-byte pages in the file.
3. Load DDT and the file with DDT filename .COM.
4. Change the byte at 0100 HEX to FF using the S command in DDT.
5. Control C to reboot CP/M and this time save the file off as a .BAS file with SAVE XX filename .BAS.

It's now a BASIC file and can be LOADed or RUN from disk just as if it were written by Microsoft BASIC. Of course, any differences in the instruction set will have to be corrected.

One last point: I will talk in HEX. I know that BASIC likes decimal, but memory dumps in decimal won't get the point across. Octal will not be considered (author's prerogative). HEX, or hexadecimal, numbers are a way of expressing 8-bit numbers using the decimal numbers 0-10 and the letters A-F. If you are not familiar with hexadecimal numbers, please refer to one of the many discussions in the literature.

With all that behind us, let's try to fix up that crashed tape. It is my experience that the most common error in reading a Tarbell tape is exhibited as a shifting to the left by one or more bits of the code. This happens when the system misses a clock pulse. In other words, it just skips a bit. Since it takes 8 bits to make a byte, it will take the 7 correct bits (with the skipped one left out), plus one from the next byte. This obviously leaves the next byte 1 bit short and the system out of sync. If we knew the exact spot of the missed clock, we could insert a bit, thereby shifting the remainder of the code one

bit to the right. But finding that spot would mean comparing the crashed file against a correct file bit by bit!

As an example, if we had a 40 HEX, which is binary 0010 0000, it would be shifted to become an 80 HEX, or 1000 000X where the X is unknown unless we know what the MSB of the next byte is. If the next byte had a 1 in the D7 position, the byte under discussion would be 1000 0001. Not 40 HEX, but 81 HEX. I'll bet you always wondered how that code could change so much! This type of error is generally such that not only one character will be wrong on the tape, but from that point on, all characters are wrong. It has been my experience that if we get a left shift in the tape, there will seldom be a right shift to compensate for it.

These problems are specially aggravated by the form of coding used in the MITS/Microsoft BASIC. You will notice that I include Microsoft. They not only wrote MIT's BASIC, but also are distributing a version on CP/M disks which seems to be compatible with the MITS versions. For you users who have Microsoft BASIC without cassette load capabilities, there is a boxed section included in this article which describes how to fool Microsoft BASIC into reading a MITS/Tarbell file. For this article, I will use M/M BASIC to mean MITS/Microsoft BASIC.

It will be necessary to look into the actual object code which is recorded on the cassette so we can determine how to recover cassette tape errors. Figure 1 is a straight object dump of the first program from the General Ledger Floppy ROM, COPCON. This was recorded with a CSAVE "A". I have played this back into memory starting at address A000 (this means it was not loaded by BASIC but by a standard bootstrap object loader). Note the first byte is a 41. This is an ASCII "A". That is the name that the file was called when it was recorded. The next word, consisting of the bytes at A001, A002 is amemory pointer 4DA5 HEX (remember that Intel format). This is a pointer to the start of the next line in the system in whic it was used, i.e. MITS Disk BASIC 4.0. The next word at location A3 and A4 is a 000A HEX. This is a decimal 10 and is the first line number.

Now starts the actual code. The 3A, 8F and DB are the MITS tokens for a remark. Then the 20 is an ASCII space and is followed by the title of the program in ASCII. You may refer to the listing in INTERFACE AGE, or if you have this file running, to the listing on your own computer. I would like to note that the programs source shown in the November 1977 INTERFACE AGE has been sanitized by removing Mr. Shamburger's address (generally on lines 30, 40, 50 and 60). Don't let this confuse you, since the source text is not the same in this respect as the program on the Floppy ROM.

In the example of Figure 1, the first line ends at address HEX A01E. The 00 in the code signals an end of line. If this was loaded into the same version of BASIC in which it was written, this address would be 4DA5, which was the pointer at the second and third bytes of the file. The next word following the end of line is a 4DE0. This will be the pointer to the end of the second line. Following that, we can see the HEX word 0014 which is decimal 20. You got it, line number 20. The program file is made up in this manner until the end-of-file mark which will be an end-of-line pointer of 0, i.e., three consecutive zeros. This tells BASIC that it has reached the end of its file. One may question why the extra overhead of the end-of-line pointer in the file. I can only assume this is done to enable fast searches for a given line in the file.

If this program were brought up on a different version of M/M BASIC, everything would remain identical except the location pointers. As an example, Figure 2 is the same program COPCON read in by a version of M/M 4.0 Extended BASIC. Note the only changes are in the end-of-line location pointers. 4DA5 in Figure 1 went to 3838 in Figure 2. 4DE0 (at A01E) in Figure 1 changed to 3873 in Figure 2. This figures, since Disk BASIC takes more memory than extended.

This should explain how the code looks in a properly formatted file. Now take a look at the code in Figure 3. This is a portion of the program GL4 which has been loaded to start at A000 in memory. I am using this as an example since on my Floppy ROM there were four errors that I was unable to recover by changing the tone and volume control settings. The first one occurred after line 70. Note in the code at A0D5, there is an end-of-line mark followed by a location word of 4E64 and a line number 003C HEX. This is line 60. Line 60 is just a remark (3A, 8F DB) and is followed by the end-of-line mark (00), a location pointer (4EA3) and the next line number (70 = 0046 HEX).

The location pointer at A0DE and A0DF (4EA3) points to the location A11C in the buffer. But at A11C there is a 03, not a 00. This tells us that something went wrong after the start of line 70 and the end at A11C. What probably happened is that two bits got shifted off the next word and onto the 00. Notice the next word is a 39A1. This would tell BASIC to jump backwards to look for the line because line 60 pointed to 4EA3. Even M/M BASIC may have a problem with this. Also, between the last goo dpointer at buffer location A0DE and this pointer the code looks strange. You can note that there are some funny looking characters especially on the line at A110. There is a 14,15 and an 05 HEX. In general, all tokens and ASCII characters in BASIC are greater than 20 HEX. When BASIC sees these funny bytes there is no telling what will happen. It usually just hangs. Worse yet, it could rewrite your disk directory. GIGO again.

The approach that will be taken to correct a crashed file is to correct from the known error (line 80) and to write fill characters in for the suspect line (line 70) since it is very difficult to tell where the error occurred. Figure 4 shows this same piece of code after correction by the recovery program. Notice from A0E2 to A11B the program has filled in "!" (ASCII 21 HEX). It will be necessary to retype in line 70 to run the program. But also notice that now the end-of-line mark at A11C is 00 and the location pointer and line number have been corrected (4EE8 and 0050).

```
A000 41 A5 4D 0A 00 3A 8F DB 20 50 52 4F 47 52 41 4D
A010 20 4E 41 4D 45 20 22 43 4F 50 43 4F 4E 22 00 E0
A020 4D 14 00 3A 8F DB 20 50 52 4F 47 52 41 4D 4D 45
A030 44 20 42 59 3A 20 20 20 20 20 42 55 44 20 53 48
A040 41 4D 42 55 52 47 45 52 20 20 20 20 44 45 43 45
A050 4D 42 45 52 20 31 39 37 36 00 0A 4E 1E 00 3A 8F
A060 DB 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
```

Figure 1.

```
A000 41 38 38 0A 00 3A 8F DB 20 50 52 4F 47 52 41 4D
A010 20 4E 41 4D 45 20 22 43 4F 50 43 4F 4E 22 00 73
A020 38 14 00 3A 8F DB 20 50 52 4F 47 52 41 4D 4D 45
A030 44 20 42 59 3A 20 20 20 20 20 42 55 44 20 53 48
A040 41 4D 42 55 52 47 45 52 20 20 20 20 44 45 43 45
A050 4D 42 45 52 20 31 39 37 36 00 9D 38 1E 00 3A 8F
A060 DB 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
```

Figure 2.

```
A0D0 2D 33 36 34 31 00 64 4E 3C 00 3A 8F DB 00 A3 4E
A0E0 46 00 3A 8F DB 20 54 48 49 53 20 50 52 4F 47 52
A0F0 41 4D 20 54 41 4B 45 53 20 54 48 45 20 44 41 54
A100 41 20 45 4E 54 45 52 45 44 20 46 52 4F 4D 20 68
A110 E1 14 81 51 15 49 35 25 39 05 30 B0 03 A1 39 40
A120 00 EA 3F 6C 80 A1 0D 21 15 0D 2C 81 39 55 35 09
A130 15 48 81 05 39 10 81 35 3D 39 15 64 81 05 35 3D
```

Figure 3.

```
A0D0 2D 33 36 34 31 00 64 4E 3C 00 3A 8F DB 00 A3 4E
A0E0 46 00 21 21 21 21 21 21 21 21 21 21 21 21 21 21
A0F0 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21
A100 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21 21
A110 21 21 21 21 21 21 21 21 21 21 21 21 00 E8 4E 50
A120 00 3A 8F DB 20 28 43 48 45 43 4B 20 4E 55 4D 42
A130 45 52 20 41 4E 44 20 4D 4F 4E 45 59 20 41 4D 4F
```

Figure 4.

A question might be, what actually happened in the code to give us an 03 at A11C. Look at the following example, which shows the bytes of A11B through A120 as they were shown in Figure 3. And right below it, what happens if we shift these to the right by 2 bits. Note, we got our correct code back. This is the approach that will be used by the program.

EXAMPLE:

```
B0        03        A1        39        04        00
1011 0000 0000 0011 1010 0001 0011 1001 0100 0000 0000 0000
??10 1100 0000 0000 1110 1000 0100 1110 0101 0000 0000 0000
?C        00        E8        4E        50        00
```

The recovery program must take the information that we know and determine where to start shifting the code and how much to shift it. There are two things that are known. Number 1, if we have a location pointer, when we look at that location in memory, it should equal 0. Remember the pointer is referenced to the version of BASIC that recorded the file. It must therefore be corrected or indexed to the present position in the buffer. If we have one complete line, this index can be calculated.

The second thing we know is the number of bytes between one end-of-line mark and the next must be less than 256, because that is the maximum line length for M/M BASIC. This can tell us if there has been a shift even though the end-of-line mark is still 00, since even a shift of one bit will change the pointer by more than 255. A shift left is like multiplying by 2 in binary and, since the files are always above the first page of memory, this will add more than 255 to the pointer.

If we detect an error by either of these tests, we can then shift right the appropriate amount to correct the error. Since we don't know where in the line the error occurred, the program will then fill that line with any legitimate ASCII fill character. Also, if the end-of-line mark was 0, but the location word was off, we better fill the previous line with fill characters too, as the shift may have occurred in the previous line.

The requirements to run this program are as follows: You must have a MITS or Microsoft BASIC, Extended or Disk, revision 4.0 or later. There also must be enough memory to run BASIC, the recovery program and still be able to load the file into a buffer outside of the range of BASIC. To recover GL2, which is 20.5K long, you may need to run the recovery program in Extended BASIC to fit in your memory. The file to be recovered must be loaded to the buffer as a straight image or object load. For this, an object loader and a method of recording the file back off are required. The programs shown in the Tarbell cassette interface manual will work fine. If you have a monitor program which records Tarbell tapes, this will also work if it is in a straight (bootstrap load) format. That is, it must not add any header bytes to the file. A monitor is also helpful (especially one that dumps in ASCII), if you would like to look around in the code and see what is going on.

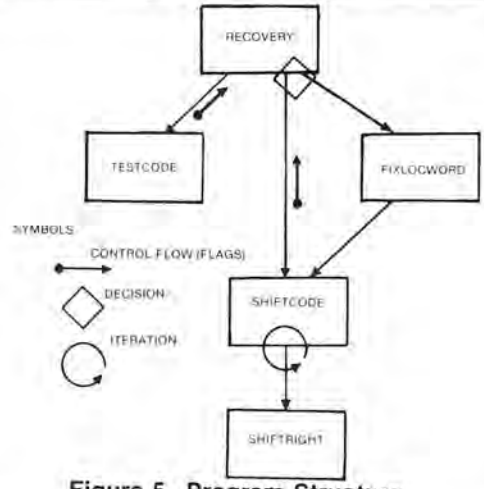

Figure 5. Program Structure

Figure 5 is a structure chart of the program with the line numbers shown referenced to the BASIC program. Figure 6 is the flow chart and a variable list. Operation of the program is as follows: The main module RECOVERY initially inputs the location of the buffer containing the code to be recovered. The buffer is defined by the start and ending address in decimal. These are stored as NBUFF and EOB. Grossly improper entries are not accepted. The first thing the program does is determine that it is possible to find at least one valid line. If not, the program must abort with an appropriate message. If it can find a valid line, then it calls to module TESTCODE at line 10000. TESTCODE will return with flags set, depending on whether the end of file was reached or an error was detected. TESTCODE also prints out valid line numbers to the terminal. If flags show that the test was complete, a message is printed and the program stops. If not, RECOVERY decides whether it was a pointer error or an end-of-line mark error. If it was a pointer error FIXLOCWORD is called. If just an end of line error, then SHIFTCODE is called. FIXLOCWORD, after fixing the pointer, will jump to SHIFTCODE. After returning from SHIFTCODE, the error LFLAG is tested to determine if recovery was possible. If not, a fatal error message is displayed and the program stopped.

If it was possible, the program loops back to line 2000 and retests to see if the complete program was corrected. This will continue until an unrecoverable error is detected or the program is corrected. The final listing to the display should show all line numbers as valid through the last line number of the program. Note that when FIXLOCWORD is correcting the pointer, the next line number may be an invalid line number. The line will be filled with the fill character anyway, so the line must be re-typed. When the corrected program is brought up by BASIC and listed, the first thing to do is delete any erroneous line numbers.

The submodules FIXLOCWORD and SHIFTCODE operate as follows: FIXLOCWORD at 16000 first fills in

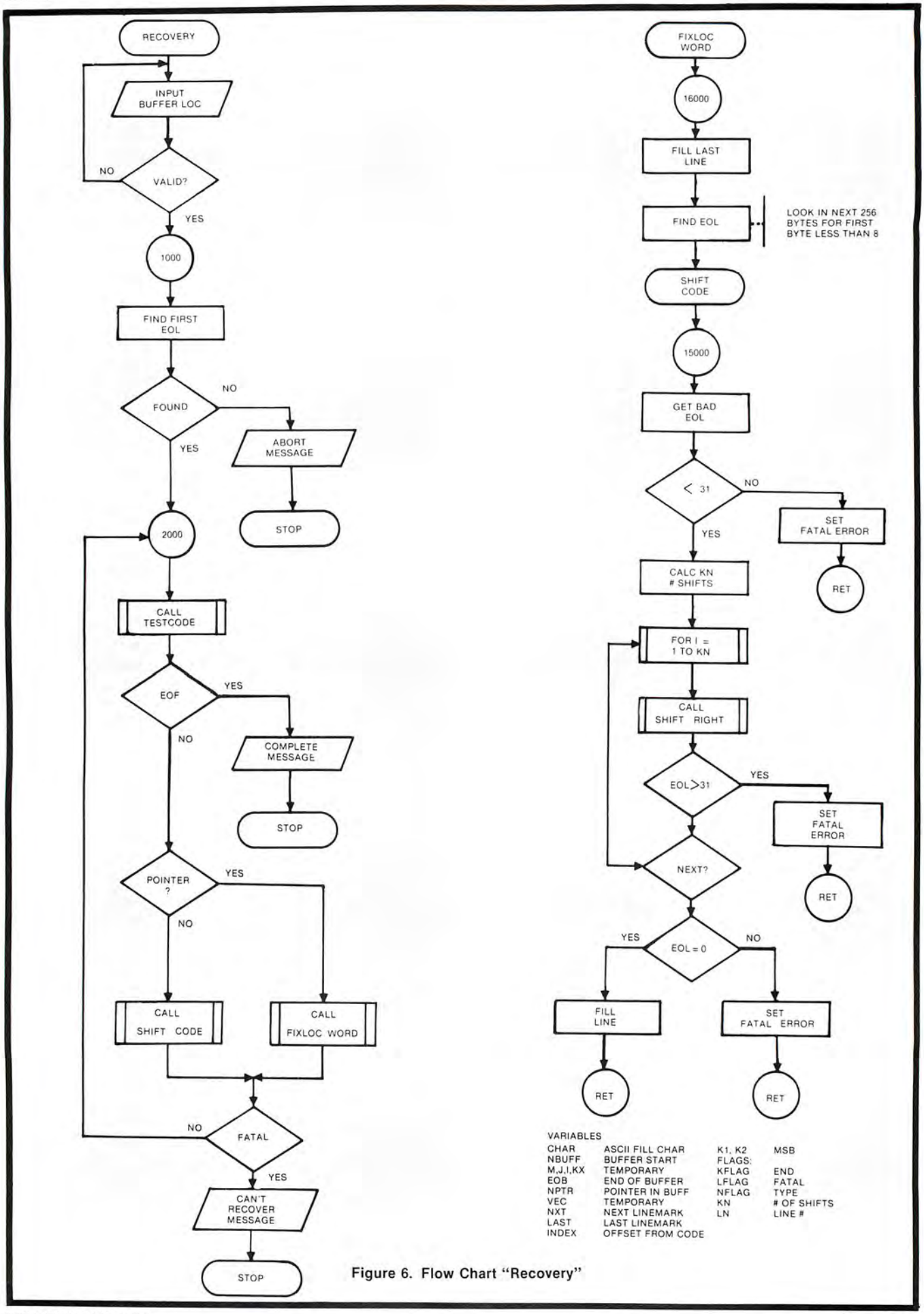

Figure 6. Flow Chart "Recovery"

the last line with fill characters. This is necessary since it is not known where in the line the clock error occurred. It then looks in the next 256 bits for the first byte less than 8. This will look for a 00 end-of-line which has been shifted less than four times. If it can't find one, it sets the fatal error flag and then returns. If it can, it assumes that this is the new end of line and POKES to the code its address as the new pointer. The module then jumps to SHIFTCODE.

In SHIFTCODE, the program first fetches the end of line. If the end of line is greater than 31, which it may be if SHIFTCODE is entered directly from RECOVERY, it sets a fatal error flag and returns. If the end of line is 31 or less, the program determines the number of shifts required to bring the end-of-line byte to 0. This is variable KN. A loop is then set up for 1 to KN times to shift the code by one bit on each pass through the loop. Actual shifting is done by a call to SHIFTRIGHT. In SHIFTRIGHT, each bit from the pointer NPTR until an end of file or EOB is shifted right by one bit. The bit which is shifted off the right hand side of the byte is added to the highest order bit of the next byte. Also, every 100 bytes the number of bytes shifted is printed out just so the operator doesn't think the computer went to sleep. This does take a while. BASIC can only PEEK and POKE so fast.

After each pass through the loop, a test is made for fatal errors, where a fatal error is indicated by the end-of-line byte being greater than 31. In other words, if our shifting has made things worse, we are not going to solve the problem. After KN passes through the loop, SHIFTCODE returns to RECOVERY with a flag set, depending on whether the end of line was corrected or not. This description, along with the comments in the code, should allow implementation on the user's system.

If this program is to be used repeatedly, I would suggest the subroutine SHIFTRIGHT be written as a user called routine (USR) in assembly code. The main lag is in this module since BASIC is not efficient at peeking, poking and shifting.

The program is used as follows: First initialize BASIC to leave a buffer above memory large enough to hold the file that needs to be corrected. Second, load the file as a memory image into the buffer. Third, return to BASIC and load and run "RECOVERY." If "RECOVERY" gives an answer showing the file was recovered, jump out of BASIC and record the buffer back off as a memory image (object) file. Now load this memory image tape with BASIC using the CLOAD command with the appropriate file letter. BASIC should respond with an OK after the load. If not, the file was not recovered; drop back 10 yards and punt.

If recovery was accomplished, list the program noting all erroneous (out of order) line numbers. Delete these first. Then list it again and correct all lines which were written over with the fill character. Remember, for all out-of-order lines that were deleted, the correct line will have to be replaced. Now save the file on cassette or disk.

Along with the program listing is a sample run recovering my file, "GL4." This file had a 2 byte shift at line 70, another shift at line 810 and a pointer error at line 1040. The program corrected all these errors (as can be seen by the partial listing) and filled the lines in with the fill character. Note that the LIST command will not work properly with the out-of-order line number (2108), which was generated while repairing the pointer at line 1050. DELETE 2108 will solve the problem. The filled in lines must now be retyped with the proper source code to create the correct file. □

PROGRAM LISTING

```
10      PRINT
        "RECOVERY":PRINT
        "A PROGRAM TO RECOVER CRASHED TARBELL TAPES":
        PRINT
        "BY:
        ORV BALCOM & BUSTER BROWN":
        PRINT
"       COPYRIGHT (c) 1978 BROWN DOG ENGINEERING":
        PRINT:PRINT


20 '    Permission is granted to copy this program
        for personal use only as long as the
        authors names and copyright notice
        are included.

30 '    This program will attempt to reconstruct a
        MITS/Microsoft program file recorded in the
        Tarbell Cassette format. Loss of clock bit
        errors will be recovered. At least one valid
        line must be initially available.

40 '    The file must be in a buffer outside of the range
        of BASIC as a memory image (non ASCII) file. The
        file will be corrected in-place and must be recorded
        off after completion.

90 '    MAIN PROGRAM:
        MODULE:RECOVERY
```

```
100     CHAR=ASC("!")'  Fill char, can be any ASCII

110 '   Get location of buffer containing file.
        Filter out garbage.

120     INPUT "INPUT START OF BUFFER (IN DECIMAL)";NBUFF

130     IF NBUFF>65535!
                GOTO 120

140     INPUT "INPUT LENGTH OF PROGRAM (IN DECIMAL)";M

150     IF M+NBUFF > 65535!
                THEN PRINT "BUFFER WILL EXCEED MEMORY":
                GOTO 120
160 '   Set buffer start & end
        NPTR is the main memory pointer in the buffer

170     EOB=M+NBUFF:
        NPTR=NBUFF

1000    VEC=INT(PEEK(NBUFF+1)+256*(PEEK(NBUFF+2)))'
                Supposed first end of line mark (EOL)
1010    NXT=VEC:

        FOR I=NBUFF+5 TO NBUFF±256:
                IF PEEK(I)=0
                THEN NXT=I:
                        I=NBUFF+256'
                See if an EOL can be found in the next 256 bytes.
                If so, set NXT= its address.

1020    NEXT

1030    IF VEC=NXT
        THEN PRINT "CAN'T FIND 1ST LINE MARKER":
                PRINT "MUST ABORT":
                STOP'
                An EOL (00) wasn't found

1040    INDEX=NXT-VEC'
                INDEX is the offset from the locations in the
                code and their actual locations in the buffer

1990 '  Clear flags and call TESTCODE.
        KLFAG is the recovery complete flag.
        NFLAG is the error type flag with 00=EOL error
        and -1=pointer error upon return from TESTCODE

2000    KFLAG=0:NFLAG=0:
        GOSUB 10000:

        IF KFLAG=-1
        THEN PRINT :PRINT "RECOVERY COMPLETE":
                PRINT"RECORD FILE BACK FROM BUFFER":
                PRINT "END OF FILE=";NPTR:
                PRINT "FILE LENGTH=";NPTR-NBUFF:
                STOP

2010 '  That is the end of the program for a complete
        recovery of the file. It is indicated by KFLAG

2020 '  Clear LFLAG, the fatal error flag and call on NFLAG
        either FIXLOCWORD (16000) or SHIFTCODE (15000)
```

```
2030    LFLAG=0:

        IF NFLAG=0
        THEN GOSUB 15000
        ELSE GOSUB 16000

2040    NPTR=NBUFF:
        GOTO 2000'
                Reset pointer to start of buffer & try again
9970 '
9980 '  MODULE: TESTCODE
        This module tests the code by jumping through it
        a line at a time. It uses the location pointer to find
        the next EOL mark. If the word indicates a jump of
        more than 255 bytes or if the EOL mark   0, an
        error has occured.

9990 '  NFLAG is set to indicate the error type and the
        program returns. If a pointer of 0 is found (EOF)
        KFLAG is set & the program returns. The # of
        valid lines are printed on the terminal.

10000   PRINT : PRINT "VALID LINES":

        FOR I=1 TO 10000:
                IF PEEK(NPTR)+PEEK(NPTR+1)+PEEK(NPTR+2)=0
                THEN KFLAG=-1:
                        RETURN

10010           NXT=PEEK(NPTR+1)+256*PEEK(NPTR+2)+INDEX:
                IF NXT > 255+NPTR
                THEN NFLAG=-1:
                RETURN'
                        Looking for a line > 255 chars
                        is a no-no. The pointer is no good
                        so set NFLAG to show it.

10020           IF PEEK(NXT) > 0
                THEN RETURN'
                        EOL error in the file

10030           LN=PEEK(NPTR+3)+256*PEEK(NPTR+4):
                PRINT LN,'
                        Get & print this lines # since
                        it seems OK.

10040           LAST=NPTR:
                NPTR=NXT:
        NEXT:
        STOP'
                Update pointers. If we really did
                10000 lines, better stop.

14980 '




14990 ' MODULE: SHIFTCODE
        This module shifts the code to the right
        until the end of line mark is 00 or
```

```
          >31 (a fatal error-can't recover)

15000     LFLAG=0:
          NXT=PEEK(NPTR+1)+256*PEEK(NPTR+2)+INDEX:
          KX=PEEK(NXT):

          IF KX > 31
          THEN LFLAG=-1:
                  RETURN'
                  Set KX = EOL mark =  NXT
                  If it's >31, the files already gone.
15010     KN=INT(LOG(KX)/LOG(2))+1:
                  NPTR=NPTR+5'
                  Calculate how many shifts to get KX to 0.
                  Move NPTR past the line #

15020 PRINT : PRINT "ATTEMPTING RECOVERY:":
          PRINT "SHIFTING ";KN;"RIGHT":
          PRINT "# OF BYTES SHIFTED:"

15030     FOR I=1 TO KN:

                  GOSUB 17000

15040             IF PEEK(NXT)=0
                  THEN I=KN:
                          GOTO 15060'
                          Call SHIFTRIGHT up to KN times or
                          until  NXT =0

15050             IF PEEK(NXT)>31
                  THEN LFLAG=-1:
                          I=KN'
                          Give up if we're making it worse

15060     NEXT:

          IF PEEK(NXT)=0
          THEN
                  FOR I=NPTR TO NXT-1:
                          POKE I,CHAR:
                  NEXT:
                  RETURN
          ELSE LFLAG=-1:
          RETURN

15070 ' If we fixed this line, fill it in & return.
          If not,set LFLAG (fatal error) & return
15980 '
15990 ' MODULE: FIXLOCWORD
          This module first fills in the last line
          since it may be bad. It then tries to find
          an end of line pointer within the next
          255 bytes that hasn't been shifted more
          than 3 times. If so, it makes it the new pointer.

16000     FOR J=LAST+5 TO NPTR-1:
                  POKE J,CHAR:
          NEXT'
          Fill in last line

16010     FOR I=1 TO 255:
                  IF PEEK(NPTR+I) < 8
```

```
        THEN NXT=NPTR+I-INDEX:
                I=256'
                Look for a byte < 8
16020   NEXT:

        IF I=255
        THEN GOTO 16030
        ELSE
        J=INT((NXT/256)+.1):
        POKE NPTR+1,NXT-256*J:
        POKE NPTR+2,J'
                If a possible EOL is found, put its
                location in the code

16030   NFLAG=0:
        GOTO 15000'
                OK, now try to correct the file

16980 '
16990 ' MODULE: SHIFTRIGHT
        This module shifts the code from NPTR until
        3 consecutive zeros are found, 1 bit to the right.

17000   K1=0:

        FOR J=NPTR TO EOB:
                K=PEEK(J):
                K2=K1

17010           IF K=0
                THEN
                        IF PEEK(J+1)+PEEK(J+2)=0
                        THEN J=EOB:
                         GOTO 17040

17020           IF (J-NPTR) MOD 100 =0
                THEN PRINT J-NPTR,

17030           K1=K MOD 2:
                K=INT(K/2):
                K=K+128*K2:
                POKE J,K'
                        K1 is the MSB to be saved
                        for the next byte. It is stored in
                        temporary register K2

17040   NEXT:
        RETURN
SAMPLE RUN   FILE:GL4

RUN "RECOVERY"
RECOVERY
A PROGRAM TO RECOVER CRASHED TARBELL TAPES
BY:
     ORV BALCOM & BUSTER BROWN
       COPYRIGHT (c) 1978 BROWN DOG ENGINEERING


INPUT START OF BUFFER (IN DECIMAL)? 40960
INPUT LENGTH OF PROGRAM (IN DECIMAL)? 3300

VALID LINES
 10             20              30              40              50
 60
```

```
ATTEMPTING RECOVERY:
SHIFTING  2 RIGHT
# OF BYTES SHIFTED:
 0              100            200            300            400
 500            600            700            800            900
 1000           1100           1200           1300           1400
 1500           1600           1700           1800           1900
 2000           2100           2200           2300           2400
 2500           2600           2700           2800           0
 100            200            300            400            500
 600            700            800            900            1000
 1100           1200           1300           1400           1500
 1600           1700           1800           1900           2000
 2100           2200           2300           2400           2500
 2600           2700           2800
VALID LINES
 10             20             30             40             50
 60             70             80             90             100
 110            120            130            140            150
 160            170            180            190            200
 210            220            230            240            250
 260            270            280            290            300
 310            320            330            340            350
 360            370            380            390            400
 410            420            430            440            450
 460            470            480            490            500
 510            520            530            540            550
 560            570            580            590            600
 610            620            630            640            650
 660            670            680            690            700
 710            720            730            740            750
 760            770            780            790            800
 810
ATTEMPTING RECOVERY:
SHIFTING  1 RIGHT
# OF BYTES SHIFTED:
 0              100            200            300            400
 500            600            700            800
VALID LINES
 10             20             30             40             50
 60             70             80             90             100
 110            120            130            140            150
 160            170            180            190            200
 210            220            230            240            250
 260            270            280            290            300
 310            320            330            340            350
 360            370            380            390            400
 410            420            430            440            450
 460            470            480            490            500
 510            520            530            540            550
 560            570            580            590            600
 610            620            630            640            650
 660            670            680            690            700
 710            720            730            740            750
 760            770            780            790            800
 810            820            830            840            850
 860            870            880            890            900
 910            920            930            940            950
 960            970            980            990            1000
 1010           1020           1030           1040
ATTEMPTING RECOVERY:
SHIFTING  1 RIGHT
# OF BYTES SHIFTED:
 0              100            200            300
```

```
VALID LINES
 10          20          30          40          50
 60          70          80          90          100
 110         120         130         140         150
 160         170         180         190         200
 210         220         230         240         250
 260         270         280         290         300
 310         320         330         340         350
 360         370         380         390         400
 410         420         430         440         450
 460         470         480         490         500
 510         520         530         540         550
 560         570         580         590         600
 610         620         630         640         650
 660         670         680         690         700
 710         720         730         740         750
 760         770         780         790         800
 810         820         830         840         850
 860         870         880         890         900
 910         920         930         940         950
 960         970         980         990         1000
 1010        1020        1030        1040        2108
 1060        1070        1080        1090        1100
 1110        1120        1130        1140        1150
 1160        1170        1180        1190        1200
 1210        1220
RECOVERY COMPLETE
RECORD FILE BACK FROM BUFFER
END OF FILE= 44082
FILE LENGTH= 3122
BREAK IN 2000
OK
LOAD "GL4"
LIST 60-80

60 '
70 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
80 ' (CHECK NUMBER AND MONEY AMOUNT FROM ENCODED MICR BANK FIELD)
OK
LIST 800-820

800 FOR J=JS TO 3
810 FIELD #1, (J-1)*42 AS D$,42 AS DREC$(J)
820 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
OK
LIST 1020-1050

1020 ' THIS ROUTINE SORTS THE TERMINAL ENTRIES ON CHECK#
1030 '
1040 !!!
OK
LIST 1040-1070

1040 !!!
OK
LIST 1040-

1040 !!!
2108 !!!!!!!!!
1060 EXH=0
1070 IF M=6 THEN 1210  ' END OF SORT - GOTO NEXT ROUTINE
 C
BREAK
OK
```

ARASEM: A Programming

By Frank Da Costa

Definitions for the term "Robot" come fast and furious these days. The central characteristic of the Robot, it is nevertheless agreed, is "lifelikeness"—that is, demonstrating the attributes of living things, particularly animals.

Robotocists spend long, hard hours trying to make their creations capable of imitating life. Wheels for motion, cameras and microphones for sensory input, speech synthesis, mechanical arms for manipulation — all these are developed so as to provide the Robot with the same basic inputs and outputs as living creatures, ideally human beings. However, I/O is not enough to complete the imitation. Unless one plans on direct remote control, some sort of programming must be developed to interpret the inputs, formulate responses, and generate outputs in some rational fashion. And that, readers, is no easy trick.

Compare some of the approaches used by robot experimenters to date. On the lower end of sophistication, there is David Heiserman's Buster III robot. The responses generated are few and predictable, based on the "hardwired" TTL logic design. The much more sophisticated automata, such as MIT's "Shakey," respond to environment via a complex internal world model. The responses are much more varied, but are still predictable. After all, as long as one works with a finite number of inputs and outputs, the responses are predictable, though the task of prediction can become quite complex.

Living things, though, as they increase in complexity, seem to elude prediction. Man, for example, has myriads of possible choices of action open to him each moment of every day. And despite the boastings of modern-day behavioral psychologists, Man's response-patterns are *not* so easily reduced to simple cause-and-effect chains. There is a missing constant, an elusive element which might be termed the "Unpredictability Factor."

Now, however vague and elusive that Factor might be, it is certainly missed when not in evidence. Robots that are easily predictable are interesting, but not completely satisfying as "lifelike." And yet, one does not want total, irrational randomness. Animals do not walk around aimlessly and bump into walls. Somewhere, in the program of philosophy of the Robot, there must be a balance between logical choice and random choice. This balance is the primary goal of ARASEM programming.

ARASEM stands for **A**rtificially **RA**ndom **SE**lf **M**otivation. The purpose of such programming is to enable the Robot to make certain "free" or random choices on its own, within the confines of some sort of limiting "rational boundaries." When the Robot is not under direct human operation, it has a number of courses of action open to it, limited only by software — programmed "probability factors." It is free to select, but it is not "out of control." This is the heart of an ARASEM approach.

This is in fact analogous to the concept of "freewill" in the human being. Environment and stimuli do not directly *determine* a person's choice, but they *do* shape it, placing border lines on it. Thus a person is truly free to choose — he is not a puppet of circumstance — and yet he makes use of his environment and experience to delimit his choice. This is an ideal concept to incorporate into the Robot.

Now let's get down to some practicals. Suppose, for the sake of discussion, that you have a Robot based on an 8080A microprocessor. The Robot might have a number of sensory inputs, such as a microphone, a bank of photocells, perhaps a proximity sensor of some type; and a number of outputs, such as wheels, arms with gripping hands, and even some sort of rudimentory audible output. It has, that is, a wide variety of available responses to a wide variety of stimuli.

In the 8080 program memory, the robotocist *could* list the whole range of responses in a row. But the robot would simple execute the whole list, without heed to input. The programmer will have to develop relationships "between I & O." But at any rate, that "list" has to go.

And so, the possible responses have to be treated rather as a "look-up table," a set of blocks with initial addresses to jump to. That way, a list of conditions can determine which response to choose. "If you hear a loud noise, jump to the 'run-like crazy' subroutine," so to speak.

But it is not enough to simply treat each single response, such as *close hand* or *move forward* as an isolated subroutine. For instance, the Robot should not move forward without regard for, say, proximity of a nearby wall. The point is, each block-response may be a simple motion, or it may need to be a medium-complex subroutine complete with conditional jumps and references to I/O or memory.

Now we have a set of programmed, software-selectable choices of action — as of yet with no way to access them. We spoke earlier of ARASEM including the concept of *artificial random* choice. What we really need for this is a good pseudorandom number generator.

It is not crucial to the discussion at hand to know *how* one generates random numbers. One might use a totally mathematical approach in software. Or perhaps one might have an external 8-bit counter running loose as an input. But assuming you have a good method of producing random 8-bit words, you can then use them as a basis for *artificially random* choice.

The first step in the ARASEM approach is to use a first random number to suggest a possible course of action — call it a *candidate* subroutine. This is done by dividing to each possible response-block an equal "slice" of the 8-bit random number. That is, if you had 8 available subroutines, each would be assigned 32 numbers out of the total 256 numbers which an 8-bit word could be. Subroutine One would be the *candidate* if the random number was from 00000000 to 00011111 (00 to 1F Hex); Subroutine Two would be the one if the number was from 00100000 to 00111111 (20 to 3F Hex); and so on. In this way, each of the 8 subroutines has an equal probability — ⅛, or 12.5% — of being the *candidate*.

The second step in the ARASEM approach is to impose a software-stored probability-percentage on the *candidate*. Each possible subroutine has a number, indi-

Approach for Robots

cating a probability percentage, stored in RAM for itself. The size of this 8-bit Probability Word is determined by the designer (more later). When a *candidate* has been suggested, a second random number is called up and is compared with the Probability Word associated with that *candidate*. If the random number is *less* than the Probability Word, then the *candidate* is accessed and performed by the robot; if the random number is *not* less, then the program loops back to Step One to find a new *candidate*.

It's easy to see how the size of the Probability Word controls probability of action. The larger a number it is, the greater the chance of the *candidate* becoming *actual*. Thus, a Probability Word of 11111111 (FF Hex) is almost 100% chance of the *candidates* being acted out; 10000000 (80 Hex) would yield about a 50% chance, and 00000000 (00 Hex) would *never* permit the choice. In this way, the programmer can shape his robot's response patterns in a complex fashion.

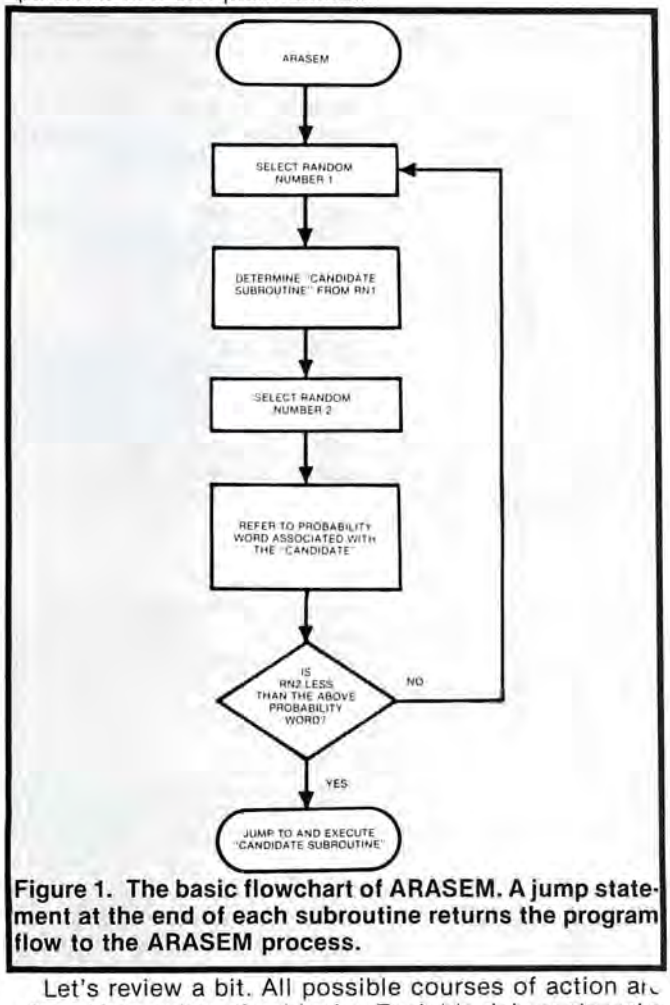

Figure 1. The basic flowchart of ARASEM. A jump statement at the end of each subroutine returns the program flow to the ARASEM process.

Let's review a bit. All possible courses of action are placed into subroutine blocks. Each block is assigned a probability to limit its chances of being accessed. A first random number suggests any one block on an equal basis. A second random number is compared to the assigned Probability Word and determines if the suggested block should be accomplished by the robot. Figure 1 illustrates this process in block form.

Program 1 provides an example of how ARASEM can be implemented, using 8080 Op Code. Remember that there are (hypothetically) eight subroutines from which to choose, each with a Probability Word to limit its chances of execution. Port 01 is assumed to be some sort of external source of 8-bit pseudorandom numbers.

The portin labeled CAND chooses a first random number and stores it in Register B for later use. Also, Register A is loaded in preparation for the next section. In STEP, a loop is set up, wherein the content of A steps in eight equal increments from 20 to FF to select a *candidate subroutine*. A is repeatedly compared to the random number in B, until A "passes" B in its upward ramp. Register C keeps track of the looping, and will result with a number from 01 to 08 — indicating one of the eight subroutines.

Now that a *candidate* has been determined, the Probability Word must come into play. PROB selects and stores a second random number in B. Using the number in C, it finds the corresponding Probability Word in the look-up table labeled TABX. Then it compares the located Probability Word with the second random number. If the random number is less than the Probability Word, then the *candidate* is confirmed to be performed by the robot. If not, the program loops back to CAND and starts all over again.

VECT makes use of that number in C to find the Upper and Lower addresses of the candidate subroutine, which are stored in the look-up table marked TABY. It loads these into Registers H and L, and thereby jumps to the subroutine. A jump-instruction at the end of the subroutine returns the program flow to the ARASEM process, starting at CAND.

This may seem a complicated approach to introducing unpredictability into a robot. And yet, there are avenues of robot response opened up by the ARASEM approach which are not easily achieved by less complex schemes.

The most attractive side-benefit of the ARASEM concept is the accessibility of those Probability Words in memory. By merely changing one 8-bit word, a whole area of response is affected. And this is a powerful tool to use in more complex program variations.

For instance, let's say that the robot chooses to run, full steam ahead, within a very small room...and crashes into a wall. A part of the program could sense that damage resulted from such an action, and could actually *decrement* the Probability Word associated with that action. Result: the robot chooses more careful actions. In effect, ARASEM is the foundation for rudimentary trial-and-error learning processes.

Amateur roboticists will spend much time developing sophisticated, dependable I/O. It's a shame to see impressively mechanical creations do nothing more significant than maneuver in a circle, or follow a light source. And yet, the home experimenter as a rule cannot afford to interface his robot's body to a PDP-10 or something. ARASEM, or some variation of it, could be an effective and moderately-easy medium to introduct homebrew robots to the world of artificial intelligence.□

PROGRAM 1

ADDRESS	HEX CODE	LABEL	OP CODE	COMMENTARY
0000	DB 01	CAND:	IN 01	Select Random Number 1
0002	47		MOV B,A	Store RN 1 in B
0003	3E FF		MVI A,FF	Load FF into A
0005	06 20	STEP:	ADI 20	Add 20 to A
0007	0C		INR C	Increment C
0008	FE FF		CPI FF	Compare FF to (A)
000A	CA 11 00		JZ PROB	Jump to PROB if (A) = FF
000D	B8		CMP B	Compare RN 1 to (A)
000E	DA 05 00		JC STEP	Loop to STEP if RN 1 > (A)
0011	DB 01	PROB:	IN 01	Select Random Number 2
0013	47		MOV B,A	Store RN 2 in B
0014	3E 30		MVI A,TABX	Move Lower Byte of TABX Address into A
0016	81		ADD C	Add C to A
0017	6F		MOV L,A	Move A to L
0018	26 00		MVI H,TABX	Move Upper Byte of TABX Address into H
001A	78		MOV A,B	Move RN 2 into A
001B	BE		CMP M	Compare RN 2 to Probability Word
001C	D2 00 00		JNC CAND	Select New Candidate if RN 2 ≮ Probability Word
001F	3E 40	VECT:	MVI A,TABY	Load A with Lower Byte of TABY Address
0021	81		ADD C	Add C to A
0022	6F		MOV L,A	Move A to L
0023	26 00		MVI H,TABY	Move Upper Byte of TABY Address to H
0025	5E		MOV E,M	Move Subroutine Lower Address Byte to E
0026	3E 08		MVI A,08	Move 08 into A
0028	85		ADD L	Add A to L
0029	6F		MOV L,A	Move A to L
002A	56		MOV D,M	Load D with Subroutine Upper Address Byte
002B	EB		XCHG	Exchange H-L with D-E
002C	E9		PCHL	Jump to Candidate Subroutine
0030	00	TABX:	NOP	Marker Byte
0031	XX		data	Probability Word 1
0032	XX		data	Probability Word 2
•	•		•	•
•	•		•	•
•	•		•	•
0038	XX		data	Probability Word 8
0040	XX		data	Subroutine 1 Lower Address
0042	XX		data	Subroutine 2 Lower Address
•	•		•	•
•	•		•	•
0048	XX		data	Subroutine 8 Lower Address
0049	XX		data	Subroutine 1 Upper Address
004A	XX		data	Subroutine 2 Upper Address
•	•		•	•
•	•		•	•
0050	XX		data	Subroutine 8 Upper Address

Program 1 An example of the ARASEM approach, written in 8080 machine language. Port 01 is assumed as an external source of pseudorandom numbers.

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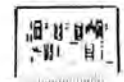

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DOCUMENTATION:

Users can't do without it; but programmers can . . . or can they?

By Tom Fay
Senior Applications Programmer, National Semiconductor

The most difficult part of writing software is the documentation. This article by Tom describes an excellent method of handling the documentation, and its importance. —*Editor*

Even before computerists have assembled the system of their dreams, many make the unpleasant discovery that those systems have an enormous appetite for software, devouring whole programs without even pausing. What is worse, it soon becomes evident that the time involved with building the system is quite small compared to the time the computerist *could* spend writing decent software.

Typically, this is when the average (or even exceptional) computerist begins a never ending search for good, useful software to add to a growing library of programs. The only problem is that, as each new gem is acquired, the hobbyist has to figure out how to adapt it, run it, and use it. What is worse, that sequence must be repeated at least partially with every re-use, especially as the program library grows. And that can slow things down considerably.

So, after pursuing this paper chase only a short while, the computerist comes to realize what some professionals still haven't learned — documentation is important. It's important to know that the game program you just got is impossible to run without a graphics capability on your TV. And it's important to know where to modify an assembler so it will take the lower case letters your keyboard produces.

Okay, fine, documentation is important, but who can stand to do it? Generally programmers spend all their time cranking out the code, which is natural since code is the bottom line of programming. Then, maybe, if there's time, they'll put some half-hearted effort into documenting the finished product, especially if they really didn't intend to do anything more than use the program themselves. The result is that documentation tends to be sketchy to begin with, and things get progressively worse from there.

First, the hobbyist standard version of software publication, passing the program from cassette to cassette, rapidly separates the documentation from the program. The first user has the documentation, and everyone else just has a copy of the program. Second, even if the documentation does miraculously manage to keep up with the software physically, it rapidly loses touch with it logically. Because of the wide variety of hardware systems in the hobbyist ranks and because *every* hobbyist has distinct tastes in system operation, the software frequently acquires new features and loses old ones at each stop in the publication cycle.

Analyzing the symptoms, it is clear the central problem is that the program and the documentation are written, published, and maintained as two separate units. They aren't, of course. They really are parts of a *system*, one which must concern itself not only with interfacing to a printer or video display, but also to the user who sits in front of that printer or display. No matter how slick a program is, it will never get used if no one knows how to.

What follows is a proposal for a documentation technique which solves this problem and has several added benefits as well:

1) Its standard format is flexible, yet it provides a familiar link to unfamiliar programs.
2) It is relatively painless to write because it becomes an integral part of the development process.
3) It is firmly attached to the software.
4) It is easily modified as the software is modified.
5) It fits easily into an automated system of documentation for maximum availability of information with minimum effort.
6) It provides an easy introduction to the software, while also providing the full details for its functioning and use.

What is this magic technique which does so much? Simply this: the documentation should be incorporated directly *into* the program, so that documentation and program are, in fact, one unit. Specifically, blocks of

```
/*      THIS IS A PL/1 COMMENT      */
C       THIS IS A FORTRAN COMMENT
*       THIS IS A 6800 OR OBM 370 COMMENT
;       THIS IS AN 8080, Z-80, OR 6502 COMMENT
REM     THIS IS A BASIC COMMENT
*b      THIS IS A COBOL COMMENT
```

Figure 1. Most assembler and higher level languages provide a means of inserting plain English commentary directly into programs.

English language comments interspersed with executing code describe the functioning of that code as well as its requirements for normal operation. Smart programmers already sprinkle comments or remarks liberally throughout their programs, knowing that even they will need such commentary after they've had time to forget the many details they juggled as they coded. Most, however, don't include comments with an eye to any kind of formal documentation.

In-program documentation of the type suggested has some obvious things going for it, solving several of the problems mentioned earlier. Program and documenta-

tion are one unit, so they stay together in the publication cycle. As one unit, documentation changes are much more likely to parallel program changes. The documentation can be done at the same time as program development (actually, as will be discussed later, it may even *precede* program development). Finally, as part of the program, the documentation can be of maximum usefulness in understanding that program.

The form in-program documentation takes it also very important if it is to be of maximum value. In recent years, a technique called HIPO — hierarchy plus input-process-output — was developed as a means of design-

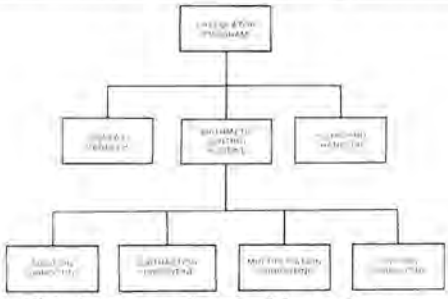

Figure 2. This is a sample of a hierarchy tree as it might be used to show the hierarchical approach to the design of a calculator program.

ing and documenting software systems. The idea behind it is the notion that all design problems can be broken down into small, easily understood parts which are much easier to solve with software. In designing a software system to perform the desired function, the designer starts at the top (hence hierarchy), defining on a general level what the system must do. As the design focuses on each element of the over-all function, a separate (lower level) unit is defined which handles just that aspect. If that specific function can be further broken down into still lower level functions, this is done as well. The process continues until the lowest level functional definitions may easily be converted into code to carry out those functions. These units of code may then be strung together to perform the overall function. The intent of this design technique is to break what may be an exceedingly complex problem into smaller, less complex, and more easily handled problems.

HIPO goes one step further by providing a uniform means of defining each of the design units so that code

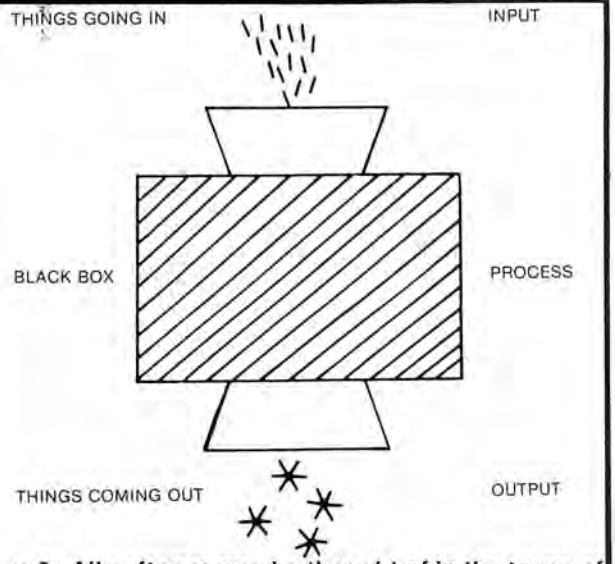

Figure 3. All software may be thought of in the terms of 'black box' processing: it has some inputs, it does some processing, and it produces some outputs.

can easily be written to carry out the function defined for that unit. Each of the functional units defined may be thought of as a black box into which various things are fed and from which various things emerge. That is, every unit has various *inputs,* performs some type of *processing,* and produces some sort of *outputs.* Thus, a natural way to define each of the HIPO units is to describe the inputs, the processing, and the outputs of that unit.

This is precisely the type of documentation which can be easily incorporated into the body of a program, in the form of comment blocks. This means that the documentation can and should be done back at the design and definition stage — before the program is even written. So, far from being an afterthought, the documentation plays an integral and useful part in the development of the software.

STANDARDS

We are now ready to define the standards for our documentation. It will consist of comment blocks which are to precede the code they describe. There should be a comment block for each unit of code, plus one for the entire program or system.

In general, the comment blocks consist of the following parts (some special purpose blocks may lack some, but not all, of these parts). Referring to Figure 4:

1) Block-start flag
2) Name and index description
3) Processing description
4) Entry conditions list
5) Exit conditions list
6) End-of-block flag

```
(1)  ;+ +  ************************************************
(2)  ;$$    BUBBLE:  SUBROUTINE—BUBBLE SORT OF NUMBERS
(3)  ;       THIS SUBROUTINE WILL SORT A TABLE OF ONE
             BYTE NUMBERS IN ASCENDING SEQUENCE.
(4)  ;     ENTRY:
             'TBLEN' CONTAINS NUMBER OF BYTES IN TABLE
               RANGE: 2-127
             'TBLAD' CONTAINS ADDRESS OF FIRST TABLE BYTE
(5)  ;     EXIT:
             'WORK1' DESTROYED
             TABLE HAS NUMBERS IN ASCENDING ORDER
             EXIT IS VIA SUBROUTINE RETURN
(6)  ;-    ************************************************
```

Figure 4. The standard documentation comment block has six parts: the start line (1), the index line (2), the process description (3), the entry conditions list (4), the exit conditions list (5), and the end flag (6).

Block-start Flag:

In order to identify the documentation blocks for easy automated extraction, the comment block should always begin with a line with the start flag of '+ +' immediately after the comment definition symbol.

Name and Index Description:

This single line gives the name of the code unit being defined, the type of code, and a brief description of the purpose of the code. The index identifier '$$' at the start of the comment makes it possible to automatically extract this index line to create documentation indexes to the program or system.

a) Name — this should be a unique name for the unit of code. If the code's entry point has a name, this should be used.
b) Code type — the type of code being documented is important to understanding how the code works. General types are:
   1) System
   2) Program
   3) Routine

4) Subroutine
5) Data
6) Other

c) Description — brief (one line) description of the code's purpose . . . *what* the code does, not how.

Processing Description:

The processing description should indicate what the code does in general terms without getting bogged down in how that processing is actually performed. The code itself should tell how the processing is done, and if it doesn't, additional comments should be added outside the documentation block. The emphasis in documentation should be on function, not logic. If the program has been sufficiently broken down into small enough units, the processing logic should be relatively clear. What might not be clear is why the program uses that logic — that is, its function.

Entry Conditions:

All the necessary entry conditions for the block should be specified:

a) All data inputs along with any restrictions on types, ranges, etc.
b) Any special entry requirements or flags.
c) Method of entry into the code.
d) Resource requirements — memory, I/O, etc.

The more exhaustive the list, the better.

Exit Conditions:

All intentional and unintentional exit conditions should be specified for each possible exit:

a) Result of the processing
b) Data outputs, including range and types.
c) Resources used-up — memory, tape, paper, etc.
d) Side effects — registers or work areas destroyed, condition codes modified, etc.
e) Exit technique and type.

End-of-block Flag:

The comment block should end with a comment beginning with the end of block flag '--'. In addition to the above standard comment block, several special purpose comment blocks suggest themselves:

1) A *Conventions Block* containing system conventions such as register usage, standard data fields, data passing protocol, etc. would simplify the documentation process even more by limiting repetition.
2) A *Data Structure Block* could contain much useful information as to table structure, data usage, range limitations, etc.

All such special comment blocks should contain at least the block start and end flags and the index line if they are to become part of the formal documentation.

DOCUMENTATION USAGE

No documentation is any good if it can't be used. The documentation defined here should see heavy use, however. It can be used to get an understanding of the function of a program or system. By analyzing the inputs and outputs, the interface to the external world can be studied. The program itself becomes clearer when an English language description of what it is doing can be compared to the program translation directly. And the comment block approach allows the reader to absorb the program logic in small, easily understood dosages.

But the documentation described does more than provide useful information on the functioning of the programs it documents. If it is done at the time of program design, it aids the programmer/designer in doing top down design using small blocks of code. Starting at the highest levels of the program, the programmer need only ensure that the main line code sets up the necessary inputs and retrieves the correct outputs as each subroutine or subfunction is encountered. In this way, the designer can follow one train of thought to its natural end while being sure that no details will be forgotten concerning the subfunctions used by the higher level functions.

That is not all. Once coded, programs may be *informally* "proven" to perform the desired function correctly. This is done by analyzing each unit of code and verifying that the inputs required are always present on entry, that the processing described really is the processing done, and that the outputs really are as advertised, with no surprises. If this is done, and a check is made that the side-effects of the unit of code do not disrupt higher level units of code using the code being checked, then it is quite possible that the program will run correctly the first time. Further, this method of check-out can often find bugs which only massive amounts of testing would uncover—that is, bugs which would normally show up long after the program was in use and presumably "bug free."

Even the testing and debugging are easier using this form of in-program documentation. Each unit of code can be checked out by feeding it inputs as defined in the documentation and verifying that the outputs generated are correct. Debugging is easier too since problems can be quickly traced to the specific unit of code doing the erroneous processing by means of the index lines describing the various functions.

For much the same reason, program modifications are much easier because code performing specific tasks can be easily identified via the comment block. Changes can then be made by modifying—or even replacing—that unit of code while maintaining the same inputs, outputs, and side-effects as the original code. This can dramatically reduce the need for "chain-reaction" type modifications, where one change leads to another in almost limitless fashion.

The usefulness of the documentation isn't limited to the original or succeeding programmers, however. Because of the special flags used, comment blocks are easily spotted and copied (but never uprooted!) automatically to be placed in other useful data organizations. In a library of programs, an index consisting of the index lines of the program-level comment blocks would allow the browser to quickly find a program of interest, while the comment blocks themselves provide information in increasing levels of detail as that detail is desired. In another organization, the comment blocks could serve as an indexed guide to a valuable resource: previously coded routines and subroutines performing a wide variety of tasks. By merely matching up inputs and outputs, these coded and tested routines could easily be used to produce new software in record time. Just think, the wheel wouldn't need reinventing ever again! □

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ABOUT THE AUTHOR

Tom Fay is a programmer analyst for the National Semiconductor Corporation, where he works on the Datachecker point of sale system. He holds an MS in mathematics from the University of Michigan and a BA, also in mathematics, from Kalamazoo College.

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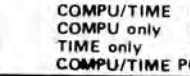

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4024	1.00	4089	3.00				
4025	.35	4093	1.75	MM74C48N	2.13	MM74C918N	4.19
4026	2.25	4098	2.50	MM74C73N	.87	MM74C922N	5.65
4027	.60	4160	1.75	MM74C74N	.87	MM74C923N	5.75
4028	1.25	4161	1.75	MM74C76N	.84	MM74C925N	17.00
4029	1.50	4162	1.75	MM74C83N	2.00		
4030	.60	4163	1.75	MM74C85N	2.00	MM74C926N	12.00
4032	1.60	4174	1.75	MM74C86N	.99		
4033	2.00	4175	1.60	MM74C90N	1.32	MM74C927N	12.00
4034	3.50	4194	1.80	MM74C93N	1.32		
4035	1.60	4501	.38	MM74C95N	1.61	MM74C928N	12.00
4038	1.60	4502	1.75	MM74C107N	1.89		
4040	1.50	4503	1.15	MM74C150N	5.67	MM80C97N	.84
4041	1.45	4506	.70	MM74C151N	3.60	MM80C98N	.84
4042	1.25	4507	1.00				
4043	1.20	4508	4.00	MM74C154N	5.67		
4044	1.25	4510	1.75	MM74C157N	3.40		
4045	2.50	4511	2.00	MM74C160N	1.71		
4046	1.95	4512	1.50	MM74C161N	1.71		
4047	2.50	4514	4.75	MM74C162N	2.57		
4048	1.00	4515	4.75	MM74C163N	1.71		
4049	.61	4516	1.75	MM74C164N	1.61		
				SM74C165N	1.61		

LINEAR

LM300H	1.70			LM2111N	1.35
LM301AH	.35			LM2900N	.90
LM301AN	.35	LM702H	.79	LM2901N	2.95
LM302H	.75	LM703CN	.45	LM2902N	3.00
LM306H	2.50	LM709CH	.40	LM2903N	1.60
LM307H	.55	LM710CH	.60	LM2904N	1.60
LM307N	.35	LM710N	.75	LM2917N	2.00
LM308AH	3.25			LM3046N	1.25
LM308AN	3.00	LM711CN	.39	LM3065N	1.00
LM308H	1.00	LM711CN	.39	LM305JN	1.50
LM308N	1.00	LM723CH	.55	LM306AN	1.25
LM310H	1.15	LM723CN	.55	LM306N	1.00
LM310N	2.00	LM725CH	2.50	LM306JN	2.60
LM311D	2.00	LM725CN	2.50	LM307AN	1.75
LM311H	.90	LM733CH	3.00	LM308JN	3.00
LM311N	.80	LM733CN	1.00	LM3146N	2.00
LM311N	.80	LM739N	1.19	LM3302N	2.00
LM312H	2.70	LM741CH	.35	LM3401N	.80
LM318H	1.50	LM741CN	.35	LM3900N	.49
LM318N	1.50	LM741CJ	.39	LM3905N	.89
LM319N	1.25	LM741CN	.39	LM3909N	.90
LM321H	3.00	LM741CN	.39	LM3911N	1.25
LM322N	3.00	LM747CH	.79		
LM324N	1.65	LM747CN	.79	LM4024N	2.75
LM339AN	3.00	LM748CH	.39	LM4044N	3.00
LM339N	.99	LM748CN	.39	LM4250CH	2.00
LM348N	1.85	LM760CN	3.00	LM4250CN	2.00
LM350N	1.00			LM4558N	.75
LM358N	1.00	LM1303N	.90		
LM370H	1.15	LM1304N	1.10	LM6656N	1.75
LM370N	2.75	LM1309N	1.40	LM5558N	1.00
LM372N	2.95	LM1310N	.85		
LM375N	3.00	LM1310N	2.75	RCA LINEAR SERIES	
LM377N	2.00	LM1358N	1.00		
LM380N	1.05	LM1414N	1.75	CA3013	2.15
LM380N	1.05	LM1458N	1.30	CA3023	2.56
LM381N	1.75	LM1458N	.50	CA3035	2.48
LM382N	1.75	LM1468N	2.90	CA3039	1.35
LM386H	.85	LM1488N	1.95	CA3046	1.30
LM387AN	.75	LM1489N	1.95	CA3059	3.25
LM387N	.95	LM1496H	.95	CA3060	3.25
LM388N	1.25	LM1496N	.95	CA3080	.85
LM389N	1.25	LM1556N	1.75		
		LM1596J	2.25	CA3081	2.00
NE531T/V	2.00	LM1800N	1.90	CA3082	2.00
NE550A	1.30	LM1808N	2.00	CA3083	1.60
NE555V	.39	LM1810N	2.00	CA3086	.85
NE556B	1.25	LM1812N	4.00	CA3089	3.75
NE560B	5.00	LM1820N	1.25	CA3130	1.39
NE562B	5.00	LM1830N	2.00	CA3140	1.25
NE565B	1.50	LM1845N	1.75	CA3401	.49
NE566B	2.00			CA3600	3.50
NE566T/V	1.75				
NE567V	1.59				

MICROPROCESSOR CRYSTALS

FREQUENCY	price
1.0 MHz	5.95
1.8432 MHz	9.80
2.0 MHz	5.95
2.097152 MHz	8.50
2.4576 MHz	8.50
2.667 MHz	8.50
3.00 MHz	8.50
3.20 MHz	8.50
3.2768 MHz	8.50
3.579545 MHz	1.25
4.0 MHz	4.95
4.0 MHz	4.95
4.194304 MHz	4.95
4.91520 MHz	4.95

FREQUENCY	price
5.0 MHz	4.95
5.0688 MHz	4.95
5.185 MHz	4.95
5.7143 MHz	4.95
6.00 MHz	4.95
6.144 MHz	4.95
6.40 MHz	4.95
6.5536 MHz	4.95
8.0 MHz	4.95
10.0 MHz	4.95
18.00 MHz	4.95
18.432 MHz	4.95
20.0 MHz	4.95
22.1184 MHz	4.95
27.0 MHz	4.95
36.0 MHz	4.95
49.0 MHz	4.95

FOR PROCESSOR TECH
14.318 $4.95

DIP SWITCHES

4 POSITION	$1.50	7 POSITION	1.80
5 POSITION	1.60	8 POSITION	2.00
6 POSITION	1.70	9 POSITION	2.25
		10 POSITION	2.50

WIRE WRAP CENTER

HOBBY-WRAP TOOL-BW-630

$34.95
Batteries not included

- Battery Operated (Size C)
- Weighs ONLY 11 Ounces
- Wraps 30 AWG Wire onto Standard DIP Sockets (.025 inch)

Complete with built-in bit and sleeve

WIRE-WRAP KIT — WK-2-W

WRAP • STRIP • UNWRAP

- Tool for 30 AWG Wire
- Roll of 50 Ft. White or Blue 30 AWG Wire
- 50 pcs. each 1 2 3 & 4 lengths — pre-stripped wire

$11.95

WIRE WRAP TOOL WSU-30

WRAP • STRIP • UNWRAP - $5.95

WIRE WRAP WIRE — 30 AWG

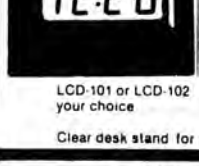
50 ft $1.95 1000 ft $15.00

SPECIFY COLOR — White - Yellow - Red - Green - Blue - Black

WIRE DISPENSER — WD-30

- 50 ft roll 30 AWG KYNAR wire wrap wire **$3.45 ea.**
- Cuts wire to desired length
- Strips 1" of insulation **Specify** — Blue-Yellow-White-Red

LIQUID CRYSTAL DIGITAL CLOCK-CALENDAR



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Small in size (2x2½x½)
Push button for seconds release for date.
Clocks mount anywhere with either 3M double-sided tape or VELCRO, included
2 MODELS AVAILABLE.
LCD-101 portable model runs on self-contained batteries for better than a year
LCD-102 runs on 12 Volt system and is back lighted

LCD-101 or LCD-102 your choice **$33.95 ea**

Clear desk stand for **$2.00**

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Built in X'TAL controlled time base. Protected against automotive volt transients. Automatic brightness control with 0.3" green color display. Display turnoff with ignition "OFF"

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Z-80A	35.00
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AM2901	22.95
6502	12.95
6800	19.95
8008-1	8.75
8080A	15.95
TMS 9900TL	89.95

6800 SUPPORT

6810P	4.95
6820P	8.00
6828P	11.25
6834P	16.95
6850P	9.95
6852P	11.95
6860P	14.95
6862P	17.95
6880P	2.70

Z80 SUPPORT DEVICES

3881	12.95
3882	12.95

F-8 SUPPORT DEVICES

3851	14.95
3853	14.95

8080A SUPPORT DEVICES

8212	3.95
8214	9.95
8216	4.50
8224	4.95
8228	8.75
8238	8.00
8251	12.00
8253	28.00
8255	12.00
8257	25.00
8259	25.00

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2513 UP	6.75
2513 DOWN	6.75
2513 UP (5v)	9.95
2513 DOWN(5v)	10.95
MCM6571	10.80
MCM6571A	10.80
MCM6572	10.80
MCM6574	14.75
MCM6575	14.75

STATIC RAMS

		1-24	25-99	100
21L02	(450)	1.50	1.40	1.25
21L02	(250)	1.95	1.80	1.50
21L11		4.25	4.10	3.95
1101A		1.49	1.29	1.10
2101-1		2.95	2.75	2.60
2102		1.25	1.15	1.00
2102-1		1.50	1.30	1.15
2111-1		4.00	3.50	3.25
2112-1		3.00	2.80	2.69
2114		17.95	16.95	16.50
4200A		12.95	12.50	11.95
5101C-E		11.95	11.25	10.25

WAVEFORM GENERATOR

8038	4.00
MC4024	2.50
566	1.75

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AY5-2376	13.95
AY5-3600	13.95

LATE ADDITIONS

TMS 4044	$14.00
TMS 5501	$24.95

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1771B-01	59.95

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2704	15.00
2708	13.00
2716	38.00
3601	4.50
5203AQ	4.00
5204AQ	6.00
6834	16.95
6834-1	14.95
82S23B	4.00
8223B	2.70

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1103	1.50
2104	4.50
2107A	3.75
2107B	4.50
2107B-4	4.00
TMS4050	4.50
TMS4060	4.50
4096	4.50
4116	42.00
MM5270	5.00
MM5280	6.00
MCM6605	6.00

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AY5-1013A	5.50
AY5-1014A	8.95
TR 1602A	5.50
TMS-6011	6.95
IM-6402	10.80
IM-6403	10.80

MISC. OTHER COMPONENTS

NH0025CN	1.70
NH0026CN	2.50
N8T20	3.50
N8T26	2.45
74367	.90
DM8098	.90
1488	1.95
1489	1.95
D-3207A	2.00
C-3404	3.95
P-3408A	5.00
P-4201	4.95
MM-5320	7.50
MM-5369	1.90
DM-8130	2.90
DM8131	2.75
DM-8831	2.50
DM-8833	2.50
DM-8835	2.50
SN74LS367	.90
SN74LS368	.90

KIM

KIM-1	245.00
6502	12.95
6520	9.00
6522	9.75
6530-002	15.95
6530-003	15.95
6530-004	15.95
6530-005	15.95

USRT

S-2350	10.95

8K STATIC RAM BOARD

ASSEMBLED & TESTED

250ns. $199.95
450ns. $150.00

* WILL WORK WITH NO FRONT PANEL
* FULL DOCUMENTATION
* FULLY BUFFERED
* S100 DESIGN
* ADEQUATELY BYPASSED
* LOW POWER SCHOTTKY SUPPORT IC S

KIT

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450ns. $129.95

BARE BOARD W/SCHEMATIC **$25.00**

ADAPT YOUR MOTOROLA **6800** SYSTEM TO OUR S-100 8K RAM BOARD. KIT PRICE $12.95

JADE VIDEO INTERFACE KIT

FEATURES **$89.95**

S-100 Bus Compatible
32 or 64 Characters per line
16 lines
Graphics (128 x 48 matrix)
Parallel & Compositive video
On board low-power memory

Powerful software included for cursor, home, EOL, Scroll Graphics/ Character, etc.
Upper case, lower case & Greek
Black-on-white & white-on-black

JADE PARALLEL/SERIAL INTERFACE KIT

S-100 $124.95 KIT

2 Serial Interfaces with RS232 interfaces or 1 Kansas City cassette interface.
Serial interfaces are crystal controlled.
Selectable baud rates.
Cassette works up to 1200 baud.
1 parallel port.

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* 13 SLOT MOTHER BOARD w/front panel slot
* S-100 DESIGN
* FULL GROUND PLANE ON ONE SIDE
* RC NETWORK TERMINATION ON EVERY LINE EXCEPT PWR & GRD
* KLUGE AREA
* STRONG 1/8" THICK DOUBLE SIDED BOARD

BARE BOARD $35.00 KIT $85.00

THE PROM SETTER

WRITE and READ EPROM

1702A-2708-2716
5204-6834

* Plugs Directly into your ALTAIR/IMSAI Computer
* Includes Main Module Board and External EPROM Socket Unit
* The EPROM Socket Unit is connected to the Computer through a 25 Pin Connector
* Programming is accomplished by the Computer
* Just Read in the Program to be Written on the EPROM into your Processor and let the Computer do the rest
* Use Socket Unit to Read EPROM's Contents into your Computer
* Software included
* No External Power Supplies. Your Computer does it all!
* Doubles as an Eight Bit Parallel I-O
* Manual included *Delivery Less than 90 days*

THE PROM SETTER
KIT $210.00 ASSEMBLED $375.00

PERSCI DISK DRIVE FOR S-100

Info 2000 S-100 DISK SYSTEM COMPLETE

(includes dual drive, power supply, case, intelligent controller, adapter, cables, and disk monitor on EPROM) **$2,650.00**

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BARE BOARD $30.00 KIT $124.95

IMSAI/ALTAIR **S-100** COMPATIBLE

JADE Z80 KIT

—with PROVISIONS for ONBOARD 2708 and POWER ON JUMP

$135.00 EA. (2MHZ)

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JADE 8080A KIT

$100.00 KIT

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You will want to know about the TV-1 Video to Televisior Interface Kit.
No need to buy a separate Video Monitor if you already own a TV set. Just connect the TV-1 between your system video output and the TV set antenna terminals - that's all there is to it - to convert your TV set to a Video Monitor, and at a much lower cost! **PRICE $8.95**

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A CAPABLE LOW COST APPROACH TO REMOTE VIDEO DISPLAY TERMINALS.

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* Communication Mode HDX/FDX Block
* Interfaces Printer Interface RS232 Extension
* RS232C Interface
* Non-Glare Read Out Screen
* Protect Mode Standard
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$975.00
Assembled

Price Includes

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MEK 6800 D2 KIT	$235.00
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9601 16 Slot Mother Bd.	175.00
9602 16 Slot Card Cage	75.00
9603 8 Slot Mother Bd.	100.00
9610 Proto Board	36.00
9615 4K EPROM Module (1702A)	250.00
9620 16 Port Parallel I/O	375.00
9626 8K Static RAM Module	295.00
9626K 8K Static RAM Kit	225.00
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Connectors $6.50	6/84.00

All assembled & tested not Kits

PLUS MOTOROLA TV MONITORS-PRIME

Model M3560-155 L01 12" display 219.95
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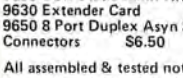
LOGOS 8K STATIC MEMORY



$125.99 Kit

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250 ns. Kits 149.95
Assembled & tested 199.95

Features: Lowpower, Dip Switch Selectable memory protect down to 256 Bytes, addressing on 1K Boundaries, No wait states, fully buffered, battery back-up.

NOW 1 Year Field Experience

SPECIAL OFFER:
Buy 4 Units Only $117.00 ea.

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Features: Power on Jump, Reset Jump, all socketed with top quality PC Board material.

SPECIAL OFFER:
Buy 4 Units Only $59.95 ea.

Z-80 CPU KIT $129.95 Kit

Low Price
(regular price 269.95)

Assembled & tested $199.95

FEATURES:
S-100 IMSAI/Altair compatible, completely compatible to TDL hardware and software. Can be used at 4MHz with Z-80A.
Add $7.00 for sockets.
Add $5.00 for Z80 manual.

NOW IN STOCK
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NSC Linear A/N Vol. II	2.95
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Intel MCS 85 Manual	4.95
Intel MCS 80 Manual	7.95
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AMI MOS Catalogue	3.95
Raytheon Linear	2.50
Raytheon Quads/Duals	1.95
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Osborne Intro to Micro Vol I	7.50
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AMI 6800 KIT EVK 99 only $133.00

Send for complete details

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Video Board (avail. future)	95.00
Connectors $6.50	12/59.95
Solid Frame Chassis	120.00
Frame Chassis	69.95
Micro Assembler ROM	30.00
Proto ROM	30.00
Tiny Basic Papertape	20.00
Tiny Basic EPROM	125.00
Hardware or Programming Manuals	15.00 ea.

8080A CPU KIT $99.95 Kit

Assembled & tested $129.95

FEATURES:
S-100 bus compatible, complete CPU with eight level vector interrupt. Includes sockets.
Add $5.00 for 8080 Manual

16K SUPERFAST RAM'S

µp D 416/4116 350ns. PRIME

Buy 8 pcs. – Only $29.95 each
Buy 16 pcs. – Only $27.95 each
Larger quantity or group buys call for current price quote.

TARBELL FLOPPY INTERFACE

Complete Kit Only $179.95
Assembled & tested $269.95

FEATURES: S100/Altair/IMSAI compatible, compatible to most disc drives including Persci, Innovex, GSI, Shugart and others.

SOFTWARE: Uses CPM which is available for $70.00
CPM documentation add $20.00

Same Day Shipment

NAKED PC BOARD SALE S-100

Z-80 CPU	$31.95
2708 EPROM 8K	21.95
8K Static RAM	21.95
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UV "EPROM" ERASER

Model UVS-11E only $59.95

Holds (4) chips at a time. Special holding tray with UVA Absorber. Exclusive safety interlock system.

Backed by 45 years UV experience.

WOW 1771 FLOPPY SPECIAL

$32.95

While they last $32.95
regular price $55.95

Western digital P/N 1771A with App. Note & Data

Only 100 units available

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2901A	29.95
INS 9900N	89.95
CP1600	39.95
6502	19.95
IM6100	29.95
• 6800P	19.95
6802P	32.95

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• 3882 (Z80 CTC)	12.95
3851 (FB Program)	14.95
3853 (FB Memory I/O)	14.95
8212 8 bit I/O	3.50
8214 Priority Interrupt	9.95
8216 Bus driver	3.75
8224 Clock Gen	4.85
8224-4 4MHz CLK Gen	12.95
• 8T26 Busdriver	2.25
8226 Busdriver	3.95
8228 Sys Controller	7.95
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8251/9551 Prog. Comm. I/O	11.95
8253 Interval Timer	21.95
8255/9555 Prog. Periph. I/O	11.95
8257 DMA Control	32.95
8259 Prog. Interrupt	32.95
6810 1 128 x 8 RAM	4.95
• 6820 PIA	7.95
6834-1 EPROM 4K	14.95
6834 EPROM 4K	16.95
6850 ACIA	9.95
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6860 Modem	14.95
6862 RPS Modulator	17.95
• 6871B 1.0 MHz Clock OSC	26.95
6880 MPU Buidriver	2.95
68 Multi Monbug 2	49.95
68 Multi Monbug 3	74.95
6831/10224 Micro Assembler Rom	30.00
6831/11003 Proto Rom	30.00
18215CD 1K RAM	15.95
18225CD 256 x 4 RAM	16.95
1824CD 32 x 8 RAM	9.95
1852CD 8 bit I/O	10.95
1856CD I/O	8.95
1857CD I/O	8.95

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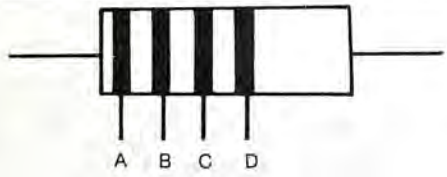
Use Your Computer to Sort Resistors

By Lucille A. Moody

A few months ago, while I was building my SWTPC CT-64 video terminal, I noticed that one of the most time consuming tasks was sorting the resistors for the kit. I used a color code table, since I can never remember the color codes, but it still took quite a bit of time. Then I had an idea. Why not write a simple program to figure the resistor values for me? It took me a few days to complete the program and get the bugs out, but it was well worth it. I was then able to sort all the remaining resistors with ease.

I think before I get into the program I should give you a little information about the color code for resistors. Referring to Figure 1, most resistors have four bands of various colors. When read from left to right, band A is the most significant figure of resistance in ohms; band B is the second significant figure; band C is the decimal multiplier, and band D is the resistance tolerance in percent. If band D is missing then this band is referred to as "no color."



Band A — First digit
Band B — Second digit
Band C — Multiplier
Band D — Tolerance

Figure 1.

When the program starts, it prints a table of resistor band colors with their associated numbers. After that you are requested to enter four band numbers. Then the resistance and tolerance are computed and printed, Figure 2.

This program was written for the SWTPC 6800 computer and the SWTPC CT-64 video terminal, which was wired for 32 characters per line. It will run in either the SWTPC 4K or 8K BASIC, versions 2.0. It could be used with any BASIC with perhaps some modifications.

This program could also be used for other purposes besides kit building. One possible use would be sorting bargain resistor assortments, which save money but take a lot of time to organize. This is one job I particularly hated to do, since unlike capacitors, the values can't be read directly from the resistors.

So the next time you are building a piece of electronic equipment, use this program to make the parts sorting go a little faster.□

PROGRAM LISTING

```
1 REM RESISTANCE COLOR CODE PROGRAM
2 REM BY LUCILLE MOODY
3 REM COMPUTER: SWTPC 6800
4 REM SUPPORT SOFTWARE: SWTPC 4K BASIC, VERSION 2.0
5 REM LIST FOR THIRD COLOR BAND (MULTIPLIER) IS READ
10 DIM X(12)
20 FOR K=1 TO 12
30 READ X(K)
40 NEXT K
50 REM INSTRUCTIONS ARE PRINTED
60 PRINT"THIS PROGRAM WILL COMPUTE"
70 PRINT"RESISTANCE VALUES FROM COLOR"
80 PRINT"CODE. ENTER COLOR BAND NUMBERS"
90 PRINT"FROM LEFT TO RIGHT SEPARATED"
100 PRINT"BY COMMAS."
110 REM COLOR CODE TABLE IS PRINTED
120 PRINT
130 PRINT"#0 BLACK";TAB(11);"#1 BROWN";TAB(21);"#2 RED"
140 PRINT"#3 ORANGE";TAB(11);"#4 YELLOW";TAB(21);"#5 GREEN"
150 PRINT"#6 BLUE";TAB(11);"#7 VIOLET";TAB(21);"#8 GREY"
160 PRINT"#9 WHITE";TAB(11);"#10 GOLD";TAB(21);"#11 SILVER"
170 PRINT"#12 NO COLOR"
180 PRINT
190 PRINT"ENTER BAND NUMBERS";
200 INPUTB1,B2,B3,B4
210 LETB3=B3+1
220 REM RESISTANCE AND TOLERANCE ARE COMPUTED AND PRINTED
230 PRINT"RESISTANCE","TOLERANCE"
240 LETR=(10*B1+B2)*X(B3)
250 IFB4=2THEN370
260 IFB4=10THEN390
270 IFB4=11THEN410
```

```
280 T=20
290 IFR>=1E6THEN330
300 IFR>=1E3THEN350
310 PRINT R;" OHMS",T;"%"
320 GOTO120
330 PRINT R/1E6;" MEG OHMS",T;"%"
340 GOTO120
350 PRINT R/1E3;" K OHMS",T;"%"
360 GOTO120
370 T=2
380 GOTO290
390 T=5
400 GOTO290
410 T=10
420 GOTO290
430 REM DATA FOR THIRD COLOR BAND
440 DATA 1,10,100,1E3,1E4,1E5,1E6,1E7,1E8,1E9,.1,.01
450 END
```

SAMPLE RUN

```
READY
#RUN
THIS PROGRAM WILL COMPUTE
RESISTANCE VALUES FROM COLOR
CODE. ENTER COLOR BAND NUMBERS
FROM LEFT TO RIGHT SEPARATED
BY COMMAS.

#0 BLACK    #1 BROWN     #2 RED
#3 ORANGE   #4 YELLOW    #5 GREEN
#6 BLUE     #7 VIOLET    #8 GREY
#9 WHITE    #10 GOLD     #11 SILVER
#12 NO COLOR

ENTER BAND NUMBERS ? 4,7,3,11

RESISTANCE              TOLERANCE
  47 K OHMS               10%
```

ABOUT THE AUTHOR

Lucille became interested in computers approximately one year ago, after taking a course in digital electronics. Her present occupation involves servicing communications and digital equipment. She is also an amateur radio operator. Her call sign is W9ST.

She built her SWTPC 6800 system in the spring of 1977 and has expanded it to 12K of memory. She is also using the SWTPC CT-64 terminal and the AC-30 cassette interface.

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Every monthly issue keeps you abreast of the latest microcomputer applications for home, school, and office. Written by professionals who know how to present microcomputing in a lively, readable, and understandable fashion, ROM is fun. ROM is instructive. ROM is everything you ever wanted in a computer magazine.

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FOR SALE: Intel single board computer with system monitor software. Board is factory assembled and complete with all ICs. Board contains RS-232C serial interface and teletype interface. Serial data rates are jumper selectable from 9600 bps to 110 bps. Board also contains three 8255 chips (72 lines parallel I/O). System monitor software permits display of all microprocessor registers; set software breakpoints for program debug and display contents of memory. $375. T. Kaplan, 7165 Leetsdale DR., Apt. D22, Denver, CO 80224, (303) 355-8920.

FOR SALE: One Processor Tech 16K static RAM board, working, $150; two Godbout 4K static RAM boards, working, $50 each; one Ithaca Audio 8K static RAM board, working, $100; one Vector Graphic 18 slot motherboard, assembled, $75; one iCOM mini-floppy system (board and floppy) with FDOS III for Sol, working, $700. one PerSci dual floppy drive, working, $800. All prices are negotiable. Jeff Roloff, 2214 Brookshire Dr., Champaign, IL 61820.

FOR SALE: Digital Group Phi Deck control baords, handles up to four decks. Like new with original documentation and software. $90. Tom Lowery, (606) 255-9958.

FOR SALE: Southwest Tech CT-64 terminal, completely assembled with all options. All ICs socketed, two pages memory, RS-232 connector, baud rate switch. Immaculate assembly, practically unused and in perfect conditon. $375. Mike Antill, P.O. Box 3833, Fullerton, CA 92631, (213) 598-1125 eves & wknds.

T-TESTS you can do on your pocket calculator. If you are concerned with more sophisticated statistical analysis and want software for your micro, write: Daniel R. Buskirk, 1230 York Ave., New York, NY 10021.

TRS-80 SORT: in BASIC I, 4K min. Sorts recs in memory on 1 or 2 numeric fields in asc. or desc. seq. Input from tape, k.b., or both. Output to tape or video. Can be subroutine. $10 on tape w/doc. To: Microware, Box 6153, Syracuse, NY 13217.

FOR SALE: Heathkit H-9 Video Terminal, assembled and working, $475. Robert Majanski, 214 Coolidge Ave., Hasbrouck Hts., NJ 07604, (201) 288-3742, after 7 p.m.

FOR SALE: Hewlett-Packard model 1601A Logic State Analyzer for use with any 180 series main frame as a display unit. Includes two model 10231A 6-Bit Data Probes, and two blue light filters, one for 182 and one for 180 series display units. See HP 1976 catalog, page 82 for more info. Brand new condition. $1400 or best offer. Mike Rosenthal, 906 NW 30th St., Corvallis, OR 97330. (503) 754-0593, evenings.

FOR SALE: MITS Dual Disk System — 8080A with heavy duty power supply, dual disk drive, 40K Seals memory, ADM-1 CRT, Okidata Printer, 2 SIO board, PROM board, disk boot loader on PROM, ACR board. Best offer. J.R. Morrow, 6501 Harding Rd. E21, Nashville, TN 37205, (615) 329-1844 day, (615) 352-0599 evenings.

FOR SALE: Heath H9 Video Terminal, fully assembled and tested by an experienced engineer. Interfaces to virtually all microcomputer systems via RS-232, 20 MA loop or TTL. Includes many unique features. Price includes shipping, $530. R. Edison, 4 Longfellow Pl., Boston, MA 02114, (617) 742-3074.

FOR SALE: Control Data 16-A computer system, 8K x 12 bits core memory, 2 multiple-device I/O channels, 350 cps paper tape reader, TTY BRPE punch (110 cps), in desk-type cabinet, 110 vac; also 161A I/O typewriter interface with stand, 168-2 aux. arith. unit, 2 model 601 mag tape drives, all documentation, software on mag tape and listed, spare cards, cables. $995 for all. Roger C. Buck, 1122 Post Dr., Rockford, IL 61108, (815) 399-2507.

FOR SALE OR TRADE: DEC Peripherals and Modules: DK8EP, $375; KL8E, $195; AD8 16 ch. A/D, $875; Omnibus expanders, power supplies, DECwriters, ASR33, etc. Send for list. Trade for ham gear or computer gear. Any DEc units repaired/ custom interfaces built. J. Simpson, Box 632, W. Caldwell, NJ 07006.

FOR SALE: Teletypes, 35 ASR's and KSR's cheap. Carl Schuch, 970 N. Main St., Orange, CA 92667, (714) 639-0600.

WANTED: Information on a FABRI-TEK Model #422, P/N 999-3761-02, 1K core memory. G. Lose, 907 Minnesota #6, Troy, MI 48084, (313) 583-9744.

WANTED: Heath compatible hardware and software. Will buy or trade extended BASIC software programs (have over 70 now). Send replies to Nick Naimo, 7468 Maple Ave., Maplewood, MO 63143.

FOR SALE: TDL 8K BASIC in PROM. Works in S-100 bus with Z80 CPU and TDL monitor. Powerful and fast. Set at addresses C000 to DFFF (out of the way). $300. E. Tottle, 2993 Yorkway, Baltimore, MD 21222.

FOR SALE: Heathkit computer system (8080 cpu) fully assembled and tested with all software. H8 computer and H9 video terminal. Contact Paul Randazzo, 37 Maxwell Dr., Wethersfield, CT 06109, (203) 529-0530. Asking $1300.

FOR SALE: Dazzler Color Terminal system, 88-4PIO, cherry keyboard and case with numeric keypad. All items function perfectly. Software and manuals included. $400 complete. Contact James Burnham, 466 W. Washington #86, El Cajon, CA 92020 after 4 p.m.

FOR SALE: Sphere System I, boards only, 6800 CPU with PROMs, CRT, power supply and cables, all with documentation. $225. W.H. Davis, P.O. Box 628, Annapolis, MD 21404, (301) 263-4832.

SWAP: Two DEC flipchips, M7319 Scratch Pad Memory, 16x256; M7336 PCS 16E; want photo equipment, Nikon, Olympus OM-1, Leica. Please send me your offering. Dr. S. Zeitlin, 250 Gorge Rd., Cliffside Park, NJ 07010.

TRADE: 12-slot Altair 8800A with HD power supply plus 10 slot IMSAI for factory assembled Altair 8800B. Both units fully socketed and factory checked out. Ken Roberts, 10560 Main, #515, Fairfax, VA 22030, (703) 591-6008 or 378-7266.

FOR SALE: Altair 8800b, 16K Altair memory card, 88-2SIO serial I/O (one port), Proc. Tech. 3P + S, 8K BASIC, all manuals, perfect running order, little used. Fully burned in, store checked and tested. Asking $1960 for all. Dr. J. Hotchin, 18 Paxwood Rd., Delmar, NY 12054, (518) 439-4122.

FOR SALE: First 13 issues of BYTE Magazine, $50. S. Gorman, 2368 Bolsover, Houston, TX 77005.

FOR SALE: Used, good condition iCOM microfloppy disk with S-100 interface and software, $600; IMSAI 4-port parallel I/O, $200; SSM video interface, $150; OAE paper tape reader, $50. Peter Kazlouski, 4234 Chestnut St., Philadelphia, PA 19104, (215) EV7-7224.

FOR SALE: Heathkit H9 video terminal assembled and tested. Used only 5 hours. $500. Howard Schimmelpfennig, 351 N. 4th West, Logan, UT 84321, (801) 752-1987.

WANTED: Technical data on a CRT terminal made by FOTO-MEM,. Inc. Terminal has Ball Bros. CRT assembly and separate cable-connected keyboard. If you have any info, drop a card to Fred Ordway, P.O. Box 5946, Washington, D.C. 20014.

TRS-80 SORT: in BASIC I, 4K min. Sorts records in memory on 1 or 2 numeric fields in asc. or desc. sequence. Input from tape, k.b., or both. Output to tape or video. Can be subroutine. $10 on tape, with documentation. Microware, Box 6153, Syracuse, NY 13217.

FOR SALE: Diablo Systems Model 31 disk drive with Interdate controller. Disk drive is 100% operational, controller needs some work. Full documentation supplied for both drive and controller. Best offer over $1200. Tom Olsen, 655 So. Fairoaks Ave., Apt. H206, Sunnyvale, CA 94086, (408) 737-9353.

FOR SALE: Two 16K dynamic memory boards, factory assembled and tested, invisible refresh, acces time 400 nsec. Use on S-100 bus Altair 8800 and IMSAI 8080. $295 each, plus shipping. A. Chong, 1718 Greenwich St., San Francisco, CA 94123, (415) 771-5496.

FOR SALE: Working CT 1024, keyboard, power supply, serial interface (RS232), computer controller curser, all socketed. $100. Les Zoltan, 151 Buckingham Dr., #280, Santa Clara, CA 95050, (408) 984-7698.

FOR SALE: Quay Z-80 CPU, factory assembled and tested, $250. VDM-1 Video Display Module, factory assembled by Processor Tech, $200. SD Sales 4-K Statis memory for S-100, Z-80 compatible, $50. Godbout-Morrow "Smart Cassette Interface" for 3 cassettes, RS232 and 20ma, $75. CCTV High-Resolution professional Video Monitor, $100. SWTPC ASCII keyboard, fully encoded w/interface and parity, in cabinet, $50. SWTPC power supply, suitable for S-100 (5, 12 and -12 volts), in cabinet, $50. IMSAI 6-slot motherboard, $15. Or take all of the above with documentation for $750. Eric Schneck, 426 E. 85th ST., #5D, New York, NY 10028, (212) 737-6458.

FOR SALE: 6-month-old Soroc terminal. 24 lines with 80 char/line, upper and lower case, block mode, protected fields, direct X/Y cursor addressing, etc. The interface is RS-232 switch selectable from 75 to 19,200 baud. Also has a numeric keypad. Perfect condition. $850. Jim Baumgardt, 6821 San Alto Wy., Buena Park, CA 90620, (714) 826-7056.

FOR SALE: two Digital Group 8K memory boards. Uses 2102-1 chips. Professional assembled and running perfectly for 3 months. $200 ea. L. Langrohr, work: (312) 262-1600, X491, home: 2069 N. Humboldt Blvd., Chicago, IL 60647.

TRS-80 LEVEL-J BASIC: Star Trek (needs 12K), list $7.00, tape, $9.95; Biorhythm (4K), list $4.50, tape $7.00; Lunar Lander (4K), list $3.00, tape $5.00. J.R. Menzies, 7106 Colgate Dr., Alexandria, VA 22307.

FOR SALE: Assembled 8080 system, Imsai 22-slot mother, large power supply, PIC-8 28K Godbout RAM, North Star Disc, PolyMorphic video board, and Digital Group keyboard and cab. $2800. Morrow Cassette Bd. assm. $79, Godbout ROM with 4K of 8080 assembler/monitor $200. 3P + S kit $110. Oliver tape reader assm. $60. C. Watrobinski, 4923 N. Kedvale, Chicago, IL 60630, (312) 736-6920.

TRS-80 OWNERS: I have the software you need to make your computer do what you want it to do. All packages on cassette with documentation. For more info write Jerry A. Hicks, 1910 Grant St., Malvern, Arkansas 72104, (501) 337-1443.

FOR SALE: Heathkit H-9 video terminal, expertly assembled, $600. Also, box of ten 8-inch Data Packaging (DP1) floppy disks, never used, $50. I pay shipping. Andy Thornburg, 400 E. Jackson St., Desoto, IL 62924.

FOR SALE: Central Data 2650 system with Elect. Tech Power Supply, S-100 adapter, and keyboard. With text editor/assembler and BASIC. You add TV, cassette recorder and turn on, $350. Three Ithica Audio 250ns 8K memory boards, $150 each. Proc. Tech 3P + S in/out, $130. Tarbell cassette interface, $100. Documentation with each. C. David Reinhart, Box 212, Louisville, IL 62858, (618) 665-3030 evenings.

FOR SALE: Cromemco bite saver with MITS 8K BASIC plus 8 PROMs, $300. With 1 PROM $150. MITS disk boot loader, $30. Multi-boot loader, $20. IMSAI 4K static, $80. MITS 4K dynamic, $80. Ken Roberts, 10560 Main, #515, Fairfax, VA 22030, (703) 591-6008 or 378-7266.

CAREER WANTED: I am looking for a challenging position programming mini/micro systems for a small company or department in the Los Angeles area. Responsibilities should be broad based. I have over 7 years experience programming all types of systems, assembler and compiler languages, and application and system programming. For a complete resume, write Gary Young, P.O. Box 66572, Los Angeles, CA 90066.

FOR SALE: Altair 8800B MPU 18 slot motherboard with 11 edge connectors, Processor Tech 3P + S and VDM-1, Tarbell I/O with Ro-Che cassette controller, keyboard model EW-100B, all assembled with cables and manuals included. $2000. or best offer. K. McLeanas, 711 E. Elizabeth Ave., Linden, NJ 07036, (201) 994-3100, ext. 268 days or (201) 925-3053 nights.

FOR SALE: TRS-80 Microprocessor with tape unit and RF modulator for use with any TV. Brand new, still under factory warranty. $499 plus shipping. Also have Medical Software for microprocessors available: patient history, health risk profile, differential diagnosis generators, clinical laboratory data analysis, symptom, disease, and drug cross-indexing, bibliography-reference retrieval, and others. Write R. Lufkin, Star Rt. 1, Box 4, Charlottesville, VA 22901.

FOR SALE: Hewlett-Packard Model 97 Printing/Programmable Calculator. Current, top-of-the-line. Excellent condition. Less than a year old. Asking $450. Perry David, 5 Sycamore Lane, Skillman, NJ 08558. (201) 885-1220 days, (609) 921-3175 evenings.

FOR SALE: Texas Instruments Silent 700 model 720 keyboard/printer data terminal. RS232 interface with cable and connector. Also has parallel input and output interfaces. Good condition, with manual, $825. Earl Petersen, (213) 889-8392.

FOR SALE: Data reference card for RCS CDP1802. Opcodes, mnemonics in alpha and numeric sequence. Cross reference, Binary/Octal/Hexadecimal/ASCII, $1.00 plus SASE, R.W. Moell, 5505 Daywood Ct., Raleigh, NC 27609.

FOR SALE: 8K-8080A system, 6 parallel I/O ports (add 2 chips for 3 more PIO and 1 serial), 3K PROM board (w/o 2708), two 4K 450nsec low power static RAM, TVT 3 terminal with cursor control, UART board, 2K RAM board, Hall effect ASCII keyboard, HITS audio cassette interface. All boards new and unused, sockets for all chips, most boards assembled. 5amp power supply, edge connectors (extra included), card guides, case, documenta-

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tion, bonus 2-60 chip ground plane w.w. proto boards with 96 gold plated ww sockets. $675 (sent UPS). Write for info, David Krivoshik, 18 Newcomb, Elizabeth, NJ 07202.

NCR high speed paper tape punches, 110V/60Hz, used but overhauled; about 100 cps (acc. to tech manual), self contained cabinet, tape spooling mechanism built-in, 8 tracks, weight 40 lbs. Delivery within 5 weeks ARO. Price $200 incl. freight. Collective orders from clubs (min. 5 punches), $150 per punch plus $100 for freight. Order accompanied by crossed checks shal be sent to Time Out, Siegfried Manfred Rambaum, Rossdoerfer 44, 6100 Darmstadt, Germany.

FOR SALE: PDP8I memory and peripherals. IBM 731 I/O terminal. All in good condition at low prices. Send SASE for list to R. Romac, Box 124, Yorkville, IL 60560 or call (815) 498-2570 after 6 p.m.

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G. ☐ Other _____

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